THE

LINE

OF

PROPORTION or NUMBERS,

Commonly called

GUNTER's LINE,

MADE EASIE:

By which may be measured all manner of Superficies and Solids; as Board, Glass, Pavement, Timber, Stone, &c.

ALSO,

How to perform the same by a Line of Equal Parts, drawn from the Centre of a *Two-Foot-Rule.*

Whereunto is added,

The Use of the Line of Proportion Improved: Whereby all manner of *Superficies* and *Solids*, may both exactly and speedily be measured, without the help of Pen or Compasses, by Inspection, looking only upon the *Ruler.*

The *Seventh Edition* carefully Corected and other new Ways of Measuring added.

By *WILLIAM LEYBOURN.*

LONDON, Printed for *A.* and *J. Churchill*, at the *Black-Swan* in *Pater-Noster-Row.* 1702.

TO THE
READER.

THIS Line *of* Proportion *or* Numbers, *commonly called (by Artificers)* Gunter's Line, *hath been diſcourſed of by ſeveral Perſons, and variouſly applied to divers Uſes; For when Mr.* Gunter *had deduced it from the* Tables *of* Logarithms, *to a* Line, *and written ſome Uſes thereof, Mr.* Wingate *added divers other of the ſame Lines, variouſly diſpoſed, thereby to* Extract *the* Square *or* Cube Roots, *without doubling or trebling the diſtance of the Compaſſes. After him, Mr.* Milbourn, *a* Yorkſhire *Gentleman, diſpoſed it in a* Serpentine *or* Spiral Line, *thereby enlarging the diviſion. Again, Mr.* William Oughtred *diſpoſed this Line in a Circle, as alſo the Lines (or*

Scales) *of Artificial* Signs *and* Tangents, *in other concentrick Circles with it; and writ the Uſes of them in Latin; which were afterwards Tranſlated into Engliſh, by Mr.* William Forſter, *and Printed under the Title of Mr.* Oughtred's Circles of Proportion. *Alſo, Mr.* Seth Partridge *contriv'd two Rulers, to ſlide one by the ſide of the other, having upon them two Lines of one length; which exactly and readily performeth all Operations wrought thereby, very exactly and ſpeedily, without the help of Compaſſes.*

Now whatſoever all the forementioned Contrivances will perform, I have here ſhewed in this Manual; and ſo ordered the Line, that it will perform the Work without Compaſſes, by Inſpection, looking only upon the Ruler. And thereby may be meaſured (let the Line be of what Length ſoever) not only Board, Glaſs, Timber, *and* Stone, *but alſo all manner of* Hangings, Pavements, Wainſcots, Plaiſtering, Tyling, Brick-work, *&c. To all which Uſes I have particularly applied*

plied it, *as will appear by ſeveral Examples in all the forementioned Particulars; and the rather, becauſe this Treatiſe may be beneficial and uſeful as well to Gentlemen and others, who may have occaſion to make uſe thereof, in Buying or Selling of* Timber, *either ſtanding, or felled, and ſquared; as to Artificers themſelves, for whoſe ſakes chiefly it was intended.*

And therefore, in the firſt Part of this Treatiſe (after the Uſe of the Vulgar Carpenter's Rule) I have ſhewed the Uſe of the Line of Proportion, which Artificers commonly call Gunter's *Line, from the Name of the Man who firſt contrived it; (and as it is now generally put upon the Flat or Edge of all Carpenters Rules) firſt, in working of the ſeveral Rules of* Arithmetick, *as* Multiplication, Diviſion, *the* Extraction *of the* Square *and* Cube Roots; *and in the working of the* Golden Rule, *or* Rule of Proportion, *whereby the Menſuration of all*

Superficies *and* Solids; *as* Board, Glaſs, Pavements, *&c. and of* Solids, *as* Timber, Stone, *&c. and perſormed by the Rule and a Pair of Compaſſes: And afterwards by ſome of thoſe other Contrivances, I have before mentioned in this Preface to the Reader, and afterwards more at large in their due places; to which and the reſt of this Manual I refer.*

Vale.

How

How to Measure BOARD and TIMBER BY THE Carpenter's Plain Rule.

ALL manner of Superficial and Solid Measures, may be measured the most absolute and artificial ways that are yet known, by the Precepts and Examples in this Book delivered: But altho' every Capacity may not attain to the knowledge and understanding thereof, I thought good here to insert the Use of that Rule which is commonly made and sold, and which every Artificer continually carries about him.

Its DESCRIPTION.

I. *Of the FORE-SIDE.*

It consisteth of two flat Sides, one of which, toward either edge thereof, is divided into 24 Equal Parts, called Inches, and numbred by 1, 2, 3, 4, and so on, to 24, at the end thereof. Every one of these Parts or Inches is again divided into two equal Parts, by Lines about half the length of the other, representing half Inches; and every of those half Inches is divided into two other equal Parts, called Quarters of Inches; and each of those again into two other equal Parts, call'd Half-quarters of Inches: So that each Inch is divided into 8 equal Parts, representing Inches, Halves, Quarters, and Half-quarters.

Both the Edges on the one side of the

the Rule are thus divided and numbred, only where 24 ends at one end of the Line on one Edge, there 1 begins on the other Edge; ſo that, which end of the Rule ſoever you meaſure with, you may count your number of Inches and Parts right, without turning of the Rule.

II. *Of the* BACK-SIDE.

On the other Side of the Rule you have two other Lines, or Scales, drawn near to the Edges of the ſame Side: One is called, *The Line of Board-Meaſure*, the other, *The Line of Timber-Meaſure*. At the beginning of either of theſe Lines you have a little Table in Figures, the one for *Board*, the other for *Timber* or *Stone*.

The Line or Scale of *Board-Meaſure* begins at 6, towards your left hand, and ſo goes on to 36, ending

juſt 4 Inches ſhort of the other end of the Rule; but ſometimes this Line is continued up to an hundred, but not often; and then it goes nearer to the end of the Rule, namely, to within an Inch and an half of the end thereof. At the beginning of this Line there is a ſmall Table, from 1 to 6 Inches, which ſhews (in Figures) the quantity of the length of a Foot of any Board, from 1 Inch broad to 6 Inches broad; and then the Diviſions ſupply the greater Breadths.

On the other Edge, on the ſame Side, you have the Line or Scale of *Timber-Meaſure*. This Scale begins at 8 and an half, and ſo goes on (by Diviſions) to 36, towards the other end of the Rule, namely 36; ending within almoſt an Inch and an half of the Rule's end. To this Scale alſo there belongeth a *Table*, which ſtandeth at the beginning of the Line, and goes from 1 Inch, to 8 Inches, and gives

gives the quantity of the length of a Foot of any *Timber* or *Stone*, under 8 Inches ſquare in Figures, as the other did for *Board*, from 1 to 6. And theſe are called, *The Tables of Under-Meaſure.*

The TABLE for UNDER-BOARD-MEASURE.

1	2	3	4	5	0
12	6	4	3	2	2
0	0	0	0	4	0

The TABLE for UNDER-TIMBER-MEASURE.

1	2	3	4	5	6	7	8
144	36	16	9	5	4	2	2
0	0	0	0	0	0	11	3

Thus much for the Deſcription of the

the Lines upon the Carpenter's Plain Rule. Now for

Their USE.

I. *Of the Fore-ſide, or Side of Inches.*

This Side is only to meaſure the Length and Breadth of any thing to be meaſured, in Inches and Parts; the manner of doing whereof is natural to every Man: for, taking the Rule in the left hand, apply it to the thing to be meaſured; ſo have you the Length, Breadth, or Thickneſs of the thing deſired. But,

II. *Of*

II. *Of the Back-ſide.*

AND,

I. *Of the Line of Board Meaſure.*

PROBL. I.

The Breadth *of any* Board *being given, to find how much thereof in* Length *will make a Foot ſquare.*

Look for the Number of Inches that your Board (or Glaſs) is broad, in the Line of *Board-Meaſure*; and the Number of Inches and parts of an Inch, which ſtand againſt that, on the other ſide of your Rule, is the quantity of Inches that will make a Foot ſquare of that Board, or Glaſs, or what other thing ſoever it be to be meaſured.

Example

Example 1. *There is a Board or Plank that is 9 Inches broad, how much of that in length will make a Foot ſquare ?*

Look for 9 Inches upon the Line of *Board-Meaſure* (which you ſhall find at the Figure 9, upon the ſame Line) and juſt againſt that, on the other ſide of your Rule, you ſhall find 16 Inches, which ſhews, that every 16 Inches of that Piece in length, will make a Foot ſquare.

Example 2. *A Pane of Glaſs, is 22 Inches broad, How much thereof in length will make a Foot ſquare ?*

Look for 22 Inches in the Line of *Board-Meaſure*, and right againſt it (on the other ſide of your Rule) you ſhall find 6 Inches, and almoſt an half; and ſo much in length of that breadth will make a Foot ſquare.

Example

Example 3. *If any plain Superficies be 30 Inches broad, How much thereof in length will make a Foot ſquare?*

Seek for 30 Inches in the Line of *Board-Meaſure*, and right againſt it, on the other ſide of the Rule, you ſhall find 4 Inches and $\frac{4}{5}$, that is, 4 Inches, and 4 fifth parts of an Inch.

Example 4. *If a Board be 9 Inches and a half broad, How much thereof in length will make a Foot ſquare?*

Seek 9 Inches and an half, in the Line of *Board-Meaſure*, and againſt that on the other ſide of the Rule, you ſhall find 15 Inches, and about 1 ſixth part of an Inch, to make a Foot ſquare.

¶ *NOTE.* All theſe Examples might be perform'd otherwiſe by the Line; for if you take the Rule in

in your left-hand, and apply the end thereof, noted with 36, to the end of the Superficies to be meaſured; the other edge of the Superficies will ſhew how many Inches, Halves, and Quarters will make a Foot ſquare. This needs no Example.

PROBL. II.

The length and breadth of a Superficies being given, to find how many ſquare Feet are therein contained.

By any of the ways (before taught) find how much of the breadth given will make a Foot ſquare; then run that length from one of the ends of the Superficies as often as you can, and ſo many ſquare Feet is there in that Superficies.

Example

Example. *A Board is 9 Inches broad, and 15 Foot long; How many ſquare Feet are therein contained?*

By the firſt Example you find that 9 Inches broad, 16 Inches in length do make a Foot: Wherefore take 16 Inches of your Rule, and run that length along the Board from one end thereof, and you ſhall find that length to be contained in the Board of 15 Foot long, 11 times, and 4 Inches over, which is $\frac{1}{4}$ of a Foot; ſo that the Board of 15 foot long, and 9 Inches broad, contains 11 Foot and one Quarter. The like of any other.

II. *Of the Line of Timber-meaſure.*

PROBL. I.

The Square of any Piece of Timber at the end thereof being given, to find how much of that Piece in length will make a Foot ſolid.

The

The Uſe of the Line of Timber meaſure, is in all reſpects the ſame a that of Board-meaſure; for knowing the ſquare of your Piece of Timber at the end thereof, you have n more to do than to look for th quantity of the Square thereof in th Line of Timber-meaſure, and righ againſt it on the other ſide of th Rule, you have the quantity of Inche that will make a Foot ſolid of tha Piece.

Example 1. *A Piece of Timber is* 1 *Inches ſquare, how much thereof i length will make a Foot ſolid?*

Look for 10 Inches in the Line o Timber-meaſure, and right againſ it on the other ſide of the Rule, yo ſhall find 17 Inches and ſomewha above a quarter of an Inch; and ſ much of that Piece in length wi make a Foot ſolid.

Exampl

Example 2. *If the Square of a Piece of Timber be* 21 *Inches, How much thereof in length will make a Foot ſolid?*

Seek 21 Inches in the Line of Timber-meaſure, and againſt it you ſhall find, on the other ſide of the Rule, almoſt 4 Inches; and ſo much in length will make a ſolid Foot of Timber.

Note 1. If Timber be broader at one end than at the other, the uſual way is to add both ends together, and take half thereof for the true Square: but if the difference be very much, this way is erroneous, though for the moſt part practiſed.

Note, 2. Alſo for round Timber, the uſual way is to girt it about the middle with a ſtring, and take a fourth part thereof for the ſquare; this alſo is erroneous: Therefore, for ſuch as

deſire

deſire curioſity and exactneſs, le
them repair to the Rules in this Boo
delivered for that purpoſe, wher
they may receive ample ſatisfactio

Concerning the Tables at the beginni
of the Lines of Board and Timbe
Meaſure.

The Table of Board-meaſure give
the length of a Foot ſquare of an
Board under 6 Inches broad; there
fore by the Table there ſet you ma
find that

		Foot	In.	Parts.
1		12	0	0
2		6	0	0
3		4	0	0
4		3	0	0
5		2	4	0
6		2	0	0

If a Board be Inches broad. will make a Foot ſquare.

By this ſmall Table you may ſee
that a Board of 4 Inches broad, wil
require 3 Foot thereof in length to
make

ake a Foot ſquare,--- Alſo, a Board
5 Inches broad will require 2 Foot,
nches, and 4 fifth parts of an Inch.
The Table of Timber meaſure gives
e length of a Foot ſolid, of any piece
Timber or Stone, whoſe ſquare is
der 8 Inches: Wherefore, by the
ble at the beginning of the Line of
imber-meaſure, you may find that

a piece of Timber	1	Inches Square.	256	0 0	will make a Foot ſolid.
	2		36	0 0	
	3		16	0 0	
	4		9	0 0	
	5		5	9 0	
	6		4	0 0	
	7		2	11 0	
	8		2	3 0	

By this Table (which is the ſame in
ect with that which ſtandeth at the
d of the Line of Timber-meaſure)
u may ſee that a piece of Timber
at is 4 Inches ſquare, requires 9
ot in length to make a ſolid Foot:
lſo a piece of 5 Inches ſquare, re-
quires

quires 5 Foot, 9 Inches, and $\frac{1}{10}$ pa of an Inch, to make a Foot ſolid. An ſo of the reſt.

But becauſe theſe Tables go onl to whole Inches, I have here adde two Tables, one for Board, the othe for Timber; the Table for Boar from one quarter of an Inch to 6 I ches in breadth; and the Table fo Timber, from two Inches ſquare 8 Inches, by Inches, Halves, and Qua ters.

The Tables follow.

The Table for Board-measure.

In.	Sq.	feet	in.	10 p.
	1	48	0	0
	2	24	0	0
	3	16	0	0
	0	12	0	0
	1	9	7	2
	2	8	0	0
	3	6	10	2
	0	6	0	0
	1	5	4	0
	2	4	9	6
	3	4	4	4
III.	0	4	0	0
	0	4	0	0
	1	3	8	3
	2	3	5	1
	3	3	2	4
IV.	0	3	0	0
	1	2	9	9
	2	2	8	0
	3	2	6	3
V.	0	2	4	8
	1	2	3	4
	2	2	2	3
	3	2	1	0

The Table for Timber-measure.

In.	Sq.	feet	in.	10 p.
	0	36	0	0
	1	28	4	3
	2	23	0	4
	3	19	0	3
III.	0	16	0	0
	1	13	7	6
	2	11	9	1
	3	10	1	8
V.	0	9	0	0
	1	7	11	6
	2	7	1	3
	3	6	4	6
V.	0	5	9	1
	1	5	2	7
	2	4	9	1
	3	4	4	2
VI.	0	4	0	0
	1	3	4	2
	2	3	4	9
	3	3	1	9
VII.	0	2	11	2
	1	2	8	1
	2	2	6	7
	3	2	5	7

The Author's Advertiſement.

IF any Gentleman, or other Perſo
deſire to be inſtructed in any
the Sciences Mathematical, as *Arit*
metick, *Geometry*, *Aſtronomy*, the U
of the *Globes*, *Trigonometry*, *Navig*
tion, *Surveying of Land*, *Dialling*,
the like; The Author will be read
to attend them at times appointed.

Alſo if any Perſon would have h
Land, or any Ground for Buildin
Surveyed, or any Edefice or Building
meaſured, either for the *Carpente*
Brick-layers, *Plaiſterers*, *Glaſiers*, *Joine*
or *Maſons* Work, he is ready t
perform the ſame either for *Maſte*
Builder or *Workman*.

Likewiſe, if any Perſon deſire t
have about his Houſe or Garden an
kind of Sun-Dial, or Dials, of wha
kind ſoever, either fix'd or moveabl
he will prepare or make for the
ſuch as they ſhall deſire.

You may hear of him where the
Books are to be ſold.

THE LINE OF Proportion, or Numbers; Commonly called *GUNTER's LINE*, MADE EASIE.

WHAT this Line is, and how to make it, is beſt known to thoſe who make *Mathematical Inſtruments*; but the Uſes of it are ſo general, that all ſorts of Men of what Faculty ſoever, may apply it to their particular Uſes; tho' it more immediately and particularly concerns ſuch Artificers whoſe Em-

ployment conſiſts in *Menſuration*: A
Carpenters, *Joyners*, *Maſons*, *Brick*
layers, *Painters*, *Glaſiers*, and ſuch
like; for that all kind of Menſurati
ons, either *SUPERFICIAL*, a
Board, *Glaſs*, *Pavement*, *Tyling*, &c
or *SOLID*, as *Timber*, *Stone*, C
lumns, *Pyramids*, &c. are by this Lin
moſt eaſily, ſpeedily and exactly per
form'd: For whatſoever thing, con
cerning Meaſure, that may be per
formed by *Arithmetick*, this Lin
will do exactly, and much ſooner
as by the working of the ſevera
Rules in *Arithmetick*, by this Line
ſhall be plainly made appear.

CHAP. I.

NUMERATION upon the Line.

BEfore I ſhew you how to num
ber upon the Line, it will be n
ceſſary to let you underſtand how th
Lin

ne is divided and numbred, as alſo
nat thoſe Diviſions and Numbers ſet
them upon the Ruler, do ſignifie.
Know therefore, that the Line of
mbers begins at the Figure One,
d ſo proceeds ſucceſſively from 1
2, 3, 4, 5, 6, 7, 8, 9, to 10 (or 1 in
e middle of the Line; and then on
rther, by 1, 2, 3, 4, 5, 6, 7, 8, 9, 10,
the end of the Line.
The firſt 1, which ſtandeth at the
ginning of the Line, repreſenteth
e *one tenth part* of any Unite or
teger, as *one tenth* part of a *Foot*,
e tenth part of a *Yard*, *Ell*, *Perch*,
ile, &c. Or it may ſignifie *one tenth*
a *Year*, *Month*, *Hour*, &c. Or
e *one tenth* of a *Pound*, *Shilling*,
Penny, &c. Or the *one tenth* part
any thing, either in *Number*,
eight, *Meaſure*, *Time*, or the like.
ne Figure 2, ſignifies *two tenth Parts*
any thing: The Figure 3, *three*
th parts: The Figure 4, *four tenth*
rts, &c. till you come to the ſecond

1, which ſtandeth in the middle o
the Line; which one ſignifieth *On*
whole Unite or *Integer*, as one whol
Foot, *Yard*, *Perch*, &c.

Now the other intermediate Div
ſions, thoſe which ſtand between th
Figures 1 and 2, (which are in numbe
ten) do repreſent (each of them) on
hundredth part of one Unite, or Inte
ger; ſo the firſt Diviſion beyond th
figure 1, repreſents 1 hundred part
of the Integer; the ſecond Diviſion
11 hundred parts of the Integer; and
ſo on: the figure 2 repreſenting 2
hundred Parts of the Integer; and the
next Diviſiou beyond 2, is 21 hundred
Parts, and ſo on, till you come to the
figure 1 in the middle of the Line
which repreſenteth one whole Inte-
ger. The figure 2 ſignifieth *two*
whole Integers; the figure 3, *three*
whole Integers, and ſo on till you come
to 10 at the end of the Line, which
ſignifieth *Ten whole Integers*; and the
intermediate Diviſions, which ſtand
be-

tween 1 and 2 in the middle of the ne, are (every of them) *tenth parts* the Integer. So the Rule contains *n whole Integers*, every of which is vided into ten parts.

But if upon the Line you would unt Numbers of more places than vo (which are all Numbers above) then the 1 which is at the begin- ng of the line, muſt be accounted *e Integer*; and the 1 in the middle the line, *ten Integers*; and the 10 the end, will be 100 *Integers*.

But yet farther, if upon the line u would expreſs Numbers of more aces than *Three* (which are all umbers above 100) then the 1 at e beginning of the line is to be ac- unted *Ten Integers*, the 1 in the mid- e *One hundred Integers*; and the 10 the end of the line, *One thouſand tegers*, &c.

And if you proceed yet farther; en the 1, at the beginning, muſt be ccounted for *one hundred Integers*;

that in the middle, *one thouſand*; an
the 10 at the end of the line, fo
Ten thouſand Integers.

In this manner you may proce
farther, by counting the firſt 1 fo
1000, 10000, *&c.* Integers; but
four places is ſufficient; which by
Rule of a competent length (as
two Foot) any queſtion concernin
Meaſuring, may be exactly enoug
perform'd.

The Diviſions and Numbers o
the Line being thus explained, it reſt
eth now to ſhew you how to find
that Point upon the Line, which ſhal
repreſent any number propoſed: and
that I ſhall ſhew you in theſe *Propo-
ſitions* following, which may fitly be
called, *NUMERATION.*

PROP

PROP. I.

A whole Number *consisting of Two, Three, or Four Places, being given; to the* Point *upon the* Line *which representeth the same.*

NOTE, let your Number given be of how many places soever; for the *First* Figure of your Number, you must take the same Figure upon the line: For the *Second* Figure in your Number, take the Number thereof on the grand (or larger) intermediate Divisions on the line. For the *Third* Figure in your Number, take the Number thereof on the smaller intermediate Divisions on the Line. And for your *Fourth* Figure, you must find its place by estimation; by supposing the space or distance of the intermediate Division to be divided into 10 parts, according to the nature of the line.

Example I. *Let it be required to find the Place of* 15 *upon the Line.*

For your firſt Figure 1, count the 1 in the middle of the Line: then for the 5, which is your ſecond Figure, count five of the grand (or larger) intermediate Diviſions upon the Line, and that point is the very place upon the Line repreſenting 15.

Note, That every fifth of the grand intermediate Diviſions is drawn forth with a longer Line than the reſt, for eaſe in counting.

Again, *To find the place upon the Line repreſenting* 37. For your firſt Figure, 3, count the Figure 3, which ſtands between the 1 in the middle, and 10 at the end upon the line; then for the 7, count 7 of the intermediate Diviſions, and that Point is the place upon the Rule repreſenting 37.

Example II. *Let it be required to find the place of* 134 *upon the Line.*

For your firſt Figure 1, count the 1, in the middle of the Line; for your ſecond

ond Figure 3, count three of the
and Diviſions; and for the third Fi-
re 4, count 4 of the ſmalleſt inter-
diate Diviſions, and that very point
he place upon the line repreſent-
134.

Again, *To find the place repreſenting* 8. For your firſt Figure 3, count e three which ſtands between the iddle 1 and 10 upon the line: For ur ſecond Figure 0 (which is a Cy-her) count none of the grand Divi-ons; but for your laſt Figure 8, ima-ne the firſt grand Diviſion following e figure 3, to be divided into 10 arts, and imagine 8 of 'em in your ind; and that Point ſhall be the ace upon the line repreſenting 308.

Example III. *Let it be required to find the place of* 1350.

For your firſt Figure 1, take 1 on the middle of the Line: For your ſe-ond Figure 3, take the Figure 3 up-n the Line upwards: For the 5, count ve of the grand intermediate Divi-

ſions; and that is the place of 1350

Again, *To find the place of* 1626 For your firſt Figure 1, count the on the middle of the Line: for you ſecond Figure 6, count the Figure upon the Line upwards: then for you third Figure 2, count two of th grand Diviſions; and for your laſt Figure 6, eſtimate ſix tenth parts o the next grand Diviſion (which i ſomething more than half the di-ſtance, becauſe 6 is more than half 10,) and that is the Point upon the line repreſenting 1626.

Note, By theſe Examples laſt mentioned, you may perceive, that the Figures 1, 2, 3, 4, 5, 6, 7, 8, 9, do ſometimes ſignifie themſelves alone, ſometimes 10, 20, 30, *&c.* ſometimes 100, 200, 300, *&c.* as the Work performed thereby ſhall require. The firſt Figure of every Number is always that which is here ſet down, and the reſt of the Figures are to be ſupplied according as the nature of the *Queſtion* ſhall require.

And

And by this variation and change of the *Powers* of theſe *Numbers* from to 10, or 100, or 1000, any Proportion, either *Arithmetical* or *Geometrical* may be wrought. One whereof I will inſert, for your better excerciſe in numbering on the *Line*; by the often practice thereof, you will find the Work facile and delightful; which ſhall be this following.

PROP. II.

Having two Number given to find as many more as you pleaſe, which ſhall be in Continual Proportion *one to another, as the two Numbers given were.*

FOR the working of this Propoſition, this is THE RULE: *Place one Foot of the Compaſſes in the firſt given Number on the Line, and extend the other Foot to the ſecond given Number; then may you turn the Com-*

paſſes

paſſes from that ſecond Number to a third, from that third to a fourth, from that fourth to a fifth, a ſixth, a ſeventh, &c. to what Number of Places you pleaſe.

Example I. *Let the two given Numbers be 2 and 4.*

Place one Foot of your Compaſſes in 2, at the beginning of the Line, and extend the other Foot to 4; then that Foot which now ſtandeth in 2, being turned about, will reach from 4 to 8, and from 8 to 16, from 16 to 32, from 32 to 64, from 64 to 128.

But when your Compaſſes ſtand in 64; if you turn them about yet farther, they will fall beyond the end of the Line; wherefore you muſt place one Foot in ſome other 64, nearer the beginning of the Line, and then the other Foot will reach to 128, and from 128 to 256, and from 256 to 512, and from 512 to 1024: but here it will go off of your Line again, where-

erefore (as before) you muſt chuſe
ther 512 nearer the beginning of
Line; and there placing your
mpaſſes, they will reach to 1024,
m 1024 to 2048, from 2048 to
06, &c.

ample II. *But if the given Number were* 10 *and* 9 Decreaſing;

Then place one Foot in 10 at the
of the Line, and extend the other
wnwards to 9; the ſame extent
l reach ſtill downwards to 8.1 (for
.) and from 8.1 to 7.29, and ſtill
wnwards from 7.29 to 6.59.

Likewiſe, if the two firſt Numbers
been as 1 to 9, the third Propor-
nal would have been 81, the fourth
9, and the fifth 656, with the ſame
ent of the Compaſſes.

Again, *Let the two Numbers be* 10
12: Place one Foot in 10, and
tend the other to 12, that extent
ll reach from 12 to 14.4, and from
ence to 17.28.

But

But if the Numbers were 1 and 12 then the third Proportional would be 144, and the fourth 1720, and all with the ſame extent of the Compaſſes.

CHAP. II.

MULTIPLICATION by the Line.

IN Multiplication, the Proportion is this: As 1 upon the Line,

Is to one of the Numbers to be multiplied:

So is the other of the Numbers to be multiplied,

To the Product of them, which is the Number ſought.

Example 1. *Let it be required to multiply 5 by 7.*

The Proportion is;

As 1: Is to 5:: So is 7: To 35.

There-

Therefore, Set one Foot of your mpaſſes in 1, and extend the other ot to 5; with that extent of the mpaſſes place one Foot in 7, and e other Foot will fall upon 35, ich is the Product.

ample II. *Let it be required to multiply* 32 *by* 9.

The Proportion is;

As 1 : To 9 : : So 32 : To 280.

Set one Foot in 1, and extend the ner Foot to 9; that ſame extent will ch from 32 to 281, which is the oduct or Sum of 32, being multied by 9. Otherwiſe,

Set one Foot in 1, and extend the ner to 32; the ſame extent will ch from 9 to 288, as before.

ample III. *Let it be required to multiply* $8\frac{75}{100}$ *by* $\frac{45}{100}$.

e Analogy or Proportion is,

A 1 : To 8.75 : : So 6.45 : to 56.44

Set one Foot in 1, and extend the her to 8.75; the ſame extent applied

plied forward upon the Line will reach from 6.45, to 56.44 *ferè*.

Or if you ſet one Foot in 1, and extend the other to 6.45: the ſame extent will reach from 8.75 to 56.4 almoſt (namely, to 43 $\frac{3}{4}$) as before.

CHAP. III.

DIVISION by the Line.

IN Diviſion three things are to be minded, *viz.*

The { *Dividend*, or Number to be divided.
Diviſor, the Number by which the Dividend is divided.
Quotient, which is the Number ſought.

And, as often as the *Diviſor* is contained in the *Dividend*, ſo often doth the *Quotient* contain *Unity*.

For

or the working of Diviſion, this
he Analogy, or Proportion.

he *Diviſor*,
to *Unity*, or 1,
s the *Dividend*,
o the *Quotient*.

mple I. *Let it be required to Divide* 35 *by* 7.

Proportion is,
s 7 : to 1 : : ſo 35 : to 5.
et one Foot of the Compaſſes in
nd extend the other Foot down-
ds to 1 ; that ſame extent will
h from 35 downwards to 5,
h is the Quotient ; and ſo many
s is 7 contained in 35.
therwiſe, extend the Compaſſes
ards from 7 to 35 ; that ſame
nt will reach upwards from 1 to
s before,

mple II. *Let it be required to divide* 288 *by* 32.

The

The Proportion is,

As 32 : to 1 : : ſo 288 : to 9.

Extend the Compaſſes downwa
from 32 to 1, the ſame extent
reach downwards from 288 t
which is the Quotient.

Or extend the Compaſſes upwa
from 32 to 288; the ſame ex
will reach upwards from 1 to 9
before.

Example III. *Let it be required t*
vide 56.34 *by* 8.75.

The Proportion is,

As 8.75 : to 1 : : ſo 55.44 : to 6

Extend the Compaſſes downwa
from 8.75 to 1; the ſame extent
reach downwards from 56.44
6.45.

Or, Extend them upwards f
8.75, to 56.44; the ſame will re
upwards from 1 to 6.45, as befor

Note this in *Diviſion*, That ſo m
times as the *Diviſor* may be orde
ſet under the *Dividend* in *Arith*

ical Work, ſo many places of *Fi-*
ures ſhall be in the *Quotient* of
our *Diviſion:* As if 34785 were
o be divided by 75, the *Quotient*
hall conſiſt of Three Figures on-
y, namely of 463, becauſe 75
an be but three times ſet orderly
nder 34785, in *Arithmetical* O-
peration.

CHAP. IV.

The GOLDEN RULE Direct by the Line.

This Rule may well be termed the *Golden Rule*, it being the moſt ful of all others: For having three mbers given, you may, by it, find ourth in proportion to them; as divers *Examples* following ſhall be de plain. And this *Rule* is per-rmed upon the *Line*, with the like ſe and Exactneſs, as any of thoſe fore mentioned: And for the orking of it upon the Line, this is e general *ANA-*

ANALOGIE or *PROPORTION*

As the *First Number* given,
Is to the *Second Number* give
So is the *Third Number* given,
To the *Fourth Number* requir

Or,

As the *First Number* given,
Is to the *Third Number* given
So is the *Second Number* given,
To the *Fourth Number* sought.

Wherefore

GENERAL RULES.

Always, *Extend the* Compaſſ
from the First Number *to t*
Second, *and that* Diſtance,
Extent, *applied the ſame w*
upon the Line, *ſhall reach fro*
the Third, *to the* Fourth Num
ber *required.*

Or, otherwiſe, *Extend the* Com
paſſes *from the* Firſt Numbe
to the Third, *and that Exten*
applied, the ſame way, ſhall alſo
reach from the Second *to the*
Fourth.

Either

ither of these ways will effect the
e things, as by *Examples* follow-
ſhall be made appear.

And it is neceſſary thus to vary the
portion, ſometimes, to avoid the
ning of the Compaſſes too wide:
when the Compaſſes are opened
very large extent, you can nei-
r take off any Diſtance exactly,
give ſo good an Eſtimate of any
ts required, as you may do when
y are opened to a leſſer diſtance:
this you will find out beſt by
ctice; and therefore I will now
ceed to Examples.

ample 1. *If* 45 *Yards of Cloth coſt*
30 l. *what will* 84 *Yards coſt at the*
ſame rate?

As 45 : to 30 : : ſo 84 : to 56.

Extend the Compaſſes from 45,
wnward to 30, that extent will
ch downward from 84, to 56*l.*
price of 84 Yards.

Or, extend the Compaſſes upwards
om 45, to 84, the ſame will reach
om 30 to 56, as before. Ex-

Example 2. *If* 26 *Acres of Land* ch
worth 64 l. *a Year*; *what is* 36 *Ac* w
of the like Land worth by the Year ny
As 26 : to 64 : : ſo 36 : ſo 88.61 ec

Extend the Compaſſes from 26 yo
64, the ſame extent will reach fro he
36 to 18 $\frac{615}{1000}$ parts (which is abo vl
12 *s.* 3*d.* 2*q.*) and ſo much is yo
Acres of the like Land worth by t o
Year. h

Example 3. *If* 100 l. *yield* 6 l. *Inter*
for one Year, or 12 *Months, wh*
ſhall 75 l. *yield?*

As 100 : to 6 : : ſo 75 : to 4.50.

Extend the Compaſſes from 100
6, the ſame extent will reach from
to 4. 50 (or $4\frac{1}{2}$) which is 4 *l.* 10
and ſo much will 75 *l.* yield Intere
in the Year

Example 4. *If* 75 l. *yield* 4 l. 10
Intereſt for one year, or 12 *month*
what will 100 l. *yield?*

As 75 : to 4.50 : : ſo 100 : to 6.

Extend the Compaſſes downward
from 75 to 4. 50, the ſame extent wi
reach

ch from 100 to 6; and such Inte-
will 100 *l.* yield.

ny other *Questions* might be ad-
ed; but the *Rule* (and manner of
working it) is so *plain*, that it needs
hem not; and so *general*, that he
which can resolve one, may as
vell resolve another: and there-
ore I shall say no more of it in
his place.

CHAP. V.

The GOLDEN-RULE Reverse by the Line.

IN this *Reverse* or *Backward Rule* of *Three*, this Note is especially be observed, That if the *Third Number* be *Greater* than the *First*, hen will the *Fourth Number* be *Less* han the *Second*. And on the con-ary; If the *Third Number* be *Less* han the *First*, then the *Fourth* Num-

ber

will be *Greater* than the *Second*: by *Examples* will appear.

Example 1. *If* 12 *Workmen, do a Piece of Work in* 8 *days, how ma Workmen ſhall do the ſame Piece Work in* 2 *days?*

It is here to be noted, That this *Queſtion*, 12 is not the firſt Num ber (though it be firſt named) but for the middlemoſt Term of th three muſt be of the ſame kind wit the fourth Number which is to b ſought; as in this *Example* it is *Me* therefore 12 (which are *men*) mu ſtand in the *middle*, or *ſecond plac* becauſe the *fourth Number*, which i to be ſought, is alſo *Men*: An therefore the Numbers ſtand thus;

days.	men.	days.
2	12	8

For if 8 days require 12 Men, then 2 days (which is but a fourth part of 8

days) ſhall require four times 12 n, that is, 48 Men.

For here, *Leſs* requires *More*; that *Leſs Time*, *More Hands*: and hence Work is contrary to the *Direct* e. Wherefore to effect it, this is

The RULE.

Extend the Compaſſes from the Third rm, *to the* Firſt: *the ſame Extent reach (being turned the contrary) from the* Second Term *to the* urth:

Or, *The extent from the* Firſt Term *he* Third, *will reach (the ſame way) m the* Second *to the* Fourth,

As in this Example.

Extend the Compaſſes from 8 wnwards to 2, the ſame extent ll reach from 12 (the contrary way the Line) to 48, which is the umber of Men that will effect the ne Piece of Work in two days.

Or, Extend the Compaſſes from to 8, the ſame extent will reach

(the ſame way) from 12 to 48, as before.

Example 2. *If* 1 *Cloſe will graze* 2 *Horſes for* 6 *Weeks, how many Horſes will the ſame Cloſe graze for* 7 *Weeks?*

Extend the Compaſſes from 6 to 7; for you muſt always extend your Compaſſes to Numbers of one kind or denomination: as here 6 and 7 are both Horſes, the ſame Extent will reach from 21 backward to 18; and ſo many Horſes will the ſame Cloſe graze for 7 Weeks.

CHAP. VI.

Of DUPLICATE PROPORTION *by the Line.*

Duplicate Proportion is ſuch a Proportion as is between *Lines* and *Superficies*, or between *Superficies* and *Lines*.

I. *Of*

I. *Of the Proportion of* LINES *to* SUPERFICIES.

The RULE.

Extend the Compaſſes from the First, *the* Second Number *of the ſame* Denomination; *that ſame extent* (*being doubled*) *ſhall give the diſtance from the* Third Number *unto the* Fourth.

Example 1. *If the* Diameter *of a* Circle *be* 14 *Inches, and the* Area *or Content thereof be* 154 *Inches; what will be the Content of another* Circle, *whoſe* Diameter *is* 28 *Inches?*

Extend the Compaſſes from 14 to 28; that extent doubled, will reach from 154 to 616: for firſt it will reach from 154 to 308, and from thence to 616; and that is the *Area* or *Content* of a *Circle* whoſe *Diameter* is 28.

Example 2. *If a Piece of Land tha* 20 *Pole ſquare, be worth* 30 l. *wh is a piece of Land of the ſame Go neſs worth, that is* 35 *Pole ſquare?*

Extend the Compaſſes from 20 35; that extent doubled will rea from 30 to 91. 8, that is, 91 *l.* $\frac{8}{10}$ a Pound, which is 16 *s.* and ſo mu is ſuch a piece of Land worth.

II. *Of the Proportion of* SUPERFICIE *to* LINES.

The RULE

Extend the Compaſſes unto the half the diſtance between the two Numbers the ſame Denomination; that ſam extent ſhall reach from the Third Num ber *to the* Fourth *required.*

Example 1. *Let there be two Circles gi ven, the Area or Content of the one be ing* 154, *and its Diameter* 14: *Th Area of the other Circle is* 616; *wha is the length of its Diameter?*

Upon

Upon your Line divide the diſtance between 154 and 616 into two equal parts; then with that diſtance ſet one Foot in 14, and the other ſhall fall upon 28, which is the length of the Diameter of the other Circle, whoſe Area is 616.

Example 2. *There is a piece of Land containing* 20 *Pole ſquare worth* 30 l. *there is another piece worth* 91 l. 16 s. *how many Pole ſquare ought that piece to contain?*

Take with your Compaſſes half the diſtance between 30 *l.* and 91 *l.* 16 *s.* then ſet one Foot in 20 Pole and the other Foot will reach to 35 Pole; and ſo many Pole ſquare muſt the Land be that is worth 91 *l.* 16 *s.*

CHAP. VII.

Of TRIPLICATE PROPORTION, by the Line.

TRiplicate *Proportion* is ſuch *Proportion* as is between *Lines* and *Solids*, or between *Solids* and *Lines*.

Of the Proportion between LINE and SOLIDS.

The RULE.

Extend the Compaſſes from the Firſt Number to the Second of the ſame Denomination; that extent (being triple) ſhall reach from the Third Number to the Fourth.

Example. *There is a Bullet whoſe Diameter is* 4 *Inches, weighing* 9 lb. *what ſhall another Bullet of the ſame Metal weigh, whoſe Diameter ſhall be* 8 *Inches?*

Extend the Compaſſes from 4 to 8 (the two *Diameters*) the ſame extent (being tripled) will reach from 9 to 72, which is the weight of the *Bullet* whoſe *Diameter* is 8 Inches.

II. Of

Of the Proportion of SOLIDS to LINES.

The RULE.

Extend the Compaſſes unto the third part of the diſtance between the two Numbers *of like* Denomination ; *that ſame extent ſhall reach from the* Third *to the* Fourth Number *required.*

Example. *The weight of a Cube being 72 pound, the Side whereof was* 8 *inches ; and the weight of another Cube of the ſame matter weighing nine pound, what muſt the Side be ?*

Upon your Line divide the diſtance between 9 and 72 into three equal parts ; then ſet one Foot of that diſtance in 8, and the other Foot ſhall reſt in 4, the length of the Side of the Cube required.

CHAP. VIII.

The Extraction of the SQUARE ROOT *by the Line.*

TO extract the *Square-Root*, is to find a *Mean Proportional Number* between 1 and the Number given; and therefore is to be found by dividing the Space between them into two equal Parts.

Example. *Let it be required to find the Square-Root of* 36.

Extend the Compaſſes from 1 to 36, the middle way upon the Line between theſe two Numbers is 6, which is the Square-Root of 36. In like manner you may find the Square-Root of 81 to be 9, of 144 to be 12, of 256 to be 16; and of other Numbers, as in this Table.

Root.

Root.	*Square.*	*Root.*	*Square.*
1	1	11	121
2	4	12	144
3	9	13	169
4	16	14	196
5	25	15	225
6	36	16	256
7	49	17	289
8	64	18	324
9	81	19	361
10	100	20	400

If you ſuppoſe the Number to have Pricks over every ſecond Figure, as is uſual in the *Arithmetical Operation*, then if the laſt Prick towards the left hand fall over the laſt Figure (which will always be when the number of Figures are *Odd*) then it will be beſt to place Unity at the 1 in the middle of the Line, ſo that the *Root* and the *Square* may both fall forwards towards 10 at the end of the Line

But if the Number of Figures *Even*, it will then be beſt to pl Unity at 10 at the end of the Lin ſo the *Root* and the *Square* both w fall backwards towards the middle the Line.

CHAP. IX.

The Extraction of the CUBE-ROO by the Line.

TO extract the *Cube-Root*, is to find the firſt of two mean Proportionals between 1 and the Number whoſe *Cube-Root* you require; and is therefore to be found upon the Line, by dividing the ſpace between them into three equal parts.

Example. *Let it be required to find the Cube-Root of* 216

Extend the Compaſſes from 1 to 216, one third part of that diſtance ſhall reach from 1 to 6, which is the

Cube-

Cube-Root of 216. In like manner you may find the *Cube*-*Root* of 729 to be 9, of 1728 to be 12, of 110592 to be 48, of 493039 to be 79, *&c.* as in this Table.

Root.	*Cube.*	*Root.*	*Cube.*
1	1	11	1331
2	8	12	1721
3	27	13	2197
4	64	14	2744
5	125	15	3375
6	216	16	4096
7	343	17	4913
8	512	18	5832
9	729	19	6859
10	1000	20	8000

Now becauſe it is troubleſome in the *Square*-*Root* to divide the ſpace into two, and in the *Cube*-*Root* into three equal Parts, you may (if you have often occaſion for this Work) have on your Rule other Lines of Numbers; as one twice, and another thrice ſo long as the other; and then this Work may be wrought upon the Lines

Lines, without dividing the diſtan upon the Line.

CHAP. X.

The Uſe of the LINE applied to Superficial-Meaſure, *ſuch as Board, Glaſs, Wainſcot, Pavement, Hangings, Painting*, &c, *of what kind ſoever.*

THE *Meaſures* by which *Board, Glaſs, Timber, Stone*, and ſuch like, are meaſured, is by the *Foot*, a Foot containing 12 *Inches*; and each Inch into eight Parts, called *Halves*, *Quarters* and *Half-quarters*: But this kind of Diviſion not being conſentaneous or agreeable to the Diviſions upon your Line of *Proportion*; where between 1 and 2 is divided (not into 8, but) into 10 Parts, the like between 2 and 3 into 10 Parts, and ſo between 3 and 4, 4 and

d 5, *&c.* Therefore I hold it re-
iſite, both for eaſe and exactneſs,
have every Inch on your Two-
ot Rule divided, not into 8, but
to 10 equal Parts, which hereafter
(throughout this Book) we will call
ch-meaſure.

Again, Whereas your *Foot* is di-
ided into 12 equal parts, called *Inch-*
s, I would have your *Foot* divided
nto 10 equal parts, and each of thoſe
parts ſubdivided into 10 other equal
parts, ſo will your whole *Foot* con-
tain 100 equal parts, which will be
agreeable to the Diviſions of your
Line, and facilitate the Work, as by
the *Examples* in this kind given will
be made to appear; and this we ſhall
hereafter call *Foot-meaſure.*

But if any Perſon be ſo wedded to
Inches, *Halves*, and *Quarters*, that he
will not be beaten out of his Opinion,
but perſiſt therein, and yet is deſirous
to have knowledge in the Uſe of this
Line; I ſay, ſuch Perſon may have ad-

ded

ded to the ſide of his Inches, Halv
and Quarters, (by way of Facing, a
term it) a Line of *Foot-meaſure*, a
alſo his Inches into 10 as well as
ſo that he may meaſure by one, a
work upon his Line by the other. A
this indeed will be neceſſary to b
done, upon the Rules of thoſe ingen
ous Artificers who need them not
for that they many times meet wit
wilful Perſons, that will have the
to meaſure their way, how diſconſen-
taneous to Reaſon ſoever it be.

In this nature would I have the Rule divided; and in this manner have I cauſed them to be made, both for my ſelf and others: And a Figure of Foot and Inch meaſure I have inſerted towards the beginning of the Book.

And here note, that what is here ſaid concerning dividing the *Inch* and *Foot* into 10 parts, the like is to be underſtood of the

the *Yard*, *Ell*, *Pole* or *Perch*, or any other *Meaſure* whatſoever.

Theſe things being premiſed, we will now proceed to Examples.

I. *Examples in Inch-meaſure only.*

Example 1. *Let a Board or Plank be 7 Inches broad, and 263 Inches long; how many ſquare Inches is there in ſuch Plank?* The Proportion is,

As 1, is to 27, the breadth in Inches:
So is 263, the length in Inches,
To 7101, the number of ſquare inches in the whole Plank.

Extend the Compaſſes from 1 to 27; the ſame extent, forwards, will reach from 263, to 7101, the Content.

Or, you may extend the Compaſſes from 1 to 263, the ſame will reach from 27 to 7101, as before.

Example 2. *Let a Pane of Glaſs be 53. 4. Inches broad, and 126. 8 Inches long; how many Foot is there in that Pane?*

The

The Proportion is,

As 144 (becauſe 144 inches mak
1 Foot)

Is to 53. 4, the breadth in inches
So is 126. 8, the length in inche
To 47. 06, the Content in Feet.

Extend the Compaſſes from 14
downwards to 53. 4; the ſame wi
reach (the ſame way) from 126. 8, t
47. 06, which is 47 Foot, and $\frac{0}{10}$
parts of a Foot, the Content of th
whole Pane.

Example 3. *If a Marble Foot-pace o
Walk be* 20 *inches broad, how much
in length of that will make a Foo
ſquare?*

The Proportion is,

As 20, the breadth in inches,
is to 144, the inches in one Foot:
So is 1 Foot unto the length of one
Foot in Inch-meaſure.

Extend the Compaſſes from 20 to 144; that extent will reach the ſame way from 1, to 7. 2: ſo that 7 inches and $\frac{2}{10}$ of that breadth will make a Foot ſquare.

II.

II. *Example in Foot-meaſure only.*

Example 1. *Let a Floor or Stone-pavement be* 52 *Foot broad, and* 110. 5 *Foot long, how many foot ſquare is that Floor or Pavement?*

The Proportion is,

As 1 Foot,
to 52 Foot the breadth:
So 100. 5 Foot the length,
to 5746 the Content in ſquare Feet.

Extend the Compaſſes from 1 to 52, the ſame will reach from 110. 5, to 5746, the content of the Pavement or Floor in ſquare Feet.

Example 2. *There is a Plank of Cedar* 2 *Foot* 25 *parts broad; how much in length thereof will make a Foot ſquare?* The Proportion is,

As 2. 25 the breadth,
is to 1:
So is 1, or any number of Feet,
to the length of a Foot ſquare in Foot-meaſure. Extend

Extend the Compaſſes from 2. to 1; that extent will reach ba from 100, which is one Foot, to parts; and ſo many parts in leng of that Plank will make a Foot. like manner 88 parts will make Foot, 1 Foot 32 parts will make Foot, *&c.* For,

As 2. 25 is to 1 Foot:

So is { 100 / 200 / 300 } Parts, to { 44 / 88 / 132 } Part

III. *Examples in* Inch-Meaſure a Foot-meaſure *together.*

Example 1. *Let a* Board *be* 30 *Inch broad; and* 15 *Foot and* $\frac{1}{2}$ *or* 25 *par long; how many Foot ſquare do ſuch a Board or Plank contain?*

The Analogy is,

As 12 Inches,
to 30 the breadth in Inches.
So 15. 25. the length in Feet,
to 38.125, the content in Feet

Extend the Compaſſes from 12 t 30, the ſame will reach from 15. 2 t

38.125; and ſo many Foot ſquare contained in ſuch a Plank.

I will conclude this Chapter with is uſeful and neceſſary *Problem:* amely;

By having the length and breadth of ny long Square, or Parallelogram given; find the length of the Side of a Geo- etrical Square equal thereunto.

This by the Line s eaſily effected; for f you take the half- iſtance upon your Line between the ength and the breadth, the Num- ber upon which the Compaſs point reſt- eth, ſhall be the length of the Side of the Geometrical Square equal to the long Square, or Parallelogram.

Note, By a long Square or Paral- lelogram is meant any Square, whoſe Sides are longer than one another, as any long Table, &c. But a Geome- trical Square is that whoſe 4 ſides are all of one length and the Angles all ſquare or right An- gles.

Example. Let the longer Side of a Parallelogram be 183 inches, and the

the breadth 30 inches: If you div
the diſtance upon your line betw
theſe two Numbers into two eq
parts, the Compaſs-point ſhall r
upon 74 inches 10 parts: So tha
Geometrical Square, whoſe ſide
74. 10, ſhall be equal in Area to
Long Square, whoſe Sides are 30 a
183.

So if you mltiply 183 by 30, t
Product will be 5490, whoſe Squa
Root is 74. 1. And 74. 1, multipli
by 74. 1, produceth 5490. 81, whi
is 5490. 1, as near as can be eſtim
ted upon the Line.

A SUPPLEMENT

the Uſe of the Line *of* Proportion, *or* Numbers: *But more particularly to this* 10*th. and the* 17*th Chapter following; performing the more difficult* Problems *concerning* Superficial *and* Solid Meaſures (*as* Board, Timber, Stone, *&c.*) *far more* Eaſily, Expeditiouſly, *and* Exactly, *than by the Ways there directed.*

FOR the effecting whereof it will be neceſſary (and ſo I would adviſe every *Artificer*) to have upon his *Two foot Rule* (beſides the common *Double-Line* of *Numbers*, as it is uſually put upon all *Two-foot Rules*) one other *Single-Line* of *Numbers* of one

one *Radius*, which muſt be exact
the Length of the other Two, whic
are upon the Common *Two-foot Rule*.
By which means theſe following (an
many other *Problems*) will be fa
more eaſily and accurately perform
ed than they can by the *Comm*
Double-line alone. I ſhall give yo
Examples of ſome few of them
whereby the reſt and (ſeveral others
will be the better apprehended.

PROP. I.

Having the Length and Breadth of a Parallelogram or Long Square, given; to find the length of the Side of a Geometrical Square, whoſe Superficial Content ſhall be equal to the long Square.

THIS hath relation to what is done in the Tenth Chapter. And

I.

I. *In* INCH-MEASURE.

Let the Length of the Parallelogram 183 inches, *and the breadth* 30 inches.——This is the Third *Example* the *Tenth Chapter* before-going.

Take with your Compaſſes (out the *Double-line* of *Numbers*) the diſtance between 30 the *Breadth*, and 183 the *Length*. The Compaſſes opened to this diſtance; Set one Foot in 30 (the leſſer Side) and the other will reach (upwards) to 74.1, in the *Single Line* of *Numbers*; and that is the Side of a *Geometrical Square* equal to the *Parallelogram*: Or,

The Compaſſes being opened from 30, to 183, in the *Double-Line*; If you ſet one Foot in 183 (the greater ſide) the other will reach (downwards) to 74. 1 Inches, the Side of the Geometrical Square.

II.

II. *In Foot-measure.*

Let there be an Oblong Superfici *whose* Breadth *let be* 7. 25 *Foot, and* Length 32. 5 *Foot : what shall the si of a* Geometrical Square *be, whose A* rea *shall be equal to the given* Paralle logram *?*

Take in your Compasses the di stance between 7. 25 (counted in th lower part of the *Double-Line*) t 32. 5 (counted in the upper part: Then set one Foot in 32. 5 counte in the *Single-Line*) and the other wil reach (downwards) to 15. 35 Foot the side of the *Geometrical Square* re quired.

Example 2. *Let there be a* Parallelo gram, *whose length is* 25. 5 *Foot; and breadth* 12. 3 *Foot: what is the side of a* Geometrical Square *equal thereunto ?*

PROB.

PROB. II.

TO find the true Square of unequal sided Timber or Stone.

I. *In Inch-measure.*

ample 1. *There is a squared Piece of* Timber, *whose Breadth at the End is* 3. 2 *Inches, and Depth* 9. 5 *Inches: hat is the side of a Square equal hereunto?*

Take out of your *Double-Line* the tance between 9. 5 and 13. 2. ith this distance, upon the *Single-ne*, set one Foot in 13. 2, and the ner will reach downwards to 11. 1 ches; the Side of the Square re-ired.

ample 2. *There is a Stone whose les at the End are* 11 *Inches and* 18 *ches: what is the Side of the Square ual thereto?*

Take the distance between 11 and 8, out of the *Double-Line*, and that

will reach upon the *Single-Line* fro 11 (upwards) or from 18 (dow wards) to 14. 70 Inches, which the Side of the Square required.

II. *In Foot-meaſure.*

Example 1. *There is a ſquared Pie of* Timber, *whoſe ſides at the En thereof are* 2.25 *Foot, and* 3. 75 *Fo what is the ſide of a Square equal the End thereof?*

The diſtance between 2. 25 and 75, taken out of the *Double-Line*, wi reach upon the *Single-Line* from 25 (upwards) or from 3. 75 (down wards) to 2. 9 Foot, which is th ſide of the Square required.

III. *Of tapering Timber.*

This hath Relation to the Work of the 17th Chapter following; and for it this one *Example* following ſhall ſuffice.

Exam-

ample. *Let there be a Piece of ſqua-red taper Timber, whoſe ſides at the greater End are* 3. 6, *and* 2. 8 *Foot*; *at the leſſer End* 2. 5, *and* 1. 7 *Foot*; *and the length thereof* 23. 4 *Foot.*

1. Extend the Compaſſes from 1, 2. 8, the ſame Extent will reach om 3. 6, to 10. 08 Foot, the *Area* the *Greater End.*

2. Extend the Compaſſes from 1, 1. 7, the ſame will reach from 2. 5, 4. 25 Foot, the *Area* of the *Leſſer nd.*

3. Take the diſtance (upon the *ouble-Line*) between 4. 25, and 10. ; that diſtance applied to the *Sin-e-Line*, will reach from 4. 25, to 6. 4 (the *Geometrical Mean* between he *Area's* of the two *Ends.*

4. Add the two *Area's* and this *eometrical Mean* together, and their umm will be 20. 87.

The *Area* { of the greater End, 10.8
of the leſſer End, 4. 2
the Geometr. Mean, 6.5
Their Summ 20. 8

Now the Length of the Piece being 23. 4 Foot, one Third part thereof is 7. 8 Foot: Wherefore,

5. Extend the Compaſſes from 1 to 7. 8 Foot (which is One Third part of the Length of the Piece) that Extent will reach from 20. 87 (the Summ of the *Area's* and Mean before found) to 162. 78 Foot: And that is the true Content of the whole Piece of Timber, which is 162 Foot, and ſomewhat above 3 quarters of a Foot.

Note. If this Piece had been meaſured by adding the *Area's* of the two Ends together, and taking the half of them, and multiplying that Half by the Length of the Piece, the Quantity would be found to be 167. 66 Foot, which is almoſt 5 Foot more than it ſhould be.

What

What is ſaid here concerning *Tapering Timber ſquared*, the like is to be underſtood of *Round Tapering Timber*, or *Timber-Trees growing*.

CHAP. XI.

Of YARD-MEASURE by the Line.

MANY Artificers, as *Joyners*, *Painters*, *Plaiſterers*, *Paviers*, *Upholſters*, &c. meaſure and ſell their Work, not by the Foot, but by the Yard: it will be neceſſary to give Examples in this kind of Meaſure alſo. And here alſo it is requiſite, that your *Yard* be divided into 100 parts and not into Halves, Quarters, and Nails: which ſuppoſed, take theſe Examples following.

Example 1. *A Joyner hath wainſco*
a Gallery containing 130 *Yards*
parts about, and in height 15 *Ya*
50 *parts; how many ſquare Yard*
in that Gallery?

The Proportion is,
As 1 yard,
to 15. 50, yards the height:
So 130. 25, the Compaſs in yar
to 2018. 87, the Content
yards. .

Extend the Compaſſes from 1
15. 50, the breadth, the ſame exte
will reach from 130. 25, the lengt
to 2018. 87: and ſo many ſquar
yards of Wainſcotting is in tha
Gallery.

Example 2. *A Painter hath painted*
Landskip, or other Work, over th
Wainſcot of a Room, which is 1. 7
parts of a Yard deep; how much i
length thereof will make a Yard ſquare
As

As the breadth 1. 75,
Is to 1 yard, or 100 parts:
So is 1, or any other Number of yards,
To the length of a yard ſquare.

Extend the Compaſſes from 1, in the middle, upwards, to 1. 75; the ſame extent will reach from 100 (or one yard) at the end, downwards to 57. 14: and ſo much in length of that painting will make a yard ſquare.

Example 3. *A Plaiſterer hath laid and beautified a Cieling, containing 13 yards broad, and 63 yards, 30 parts long; how many ſquare yards is there in that Ceiling?*

As 1 yard,
To the breadth 13. 30,
So the Length 63. 30,
To the Content.

Extend the Compaſſes from 1 to 13; the ſame extent will reach from 63. 30, to 823 almoſt: and ſo many ſquare Yards are there in ſuch a Ceiling.

Note, It may ſo fall out ſometi
that it may be required to m
ſure ſome piece of Work, a
to give an eſtimate of the quan
ty of the Yards therein contain
when you have not a Yard th
divided by you, but only yo
Two-foot Rule, for the ſuplyi
whereof, I will add this forllowi
Problem.

PROBLEM.

*The length and breadth of any Superfic
es being given in Feet, to find the Con
tent thereof in Yards.*

Let the breadth of a piece of an
Work, to be meaſured by the yard,
be 4 Foot, and the length thereof 12
Foot, how many ſquare Yards are
contained therein?

The Analogy or Proportion is,
As 9, the Feet in one Yard,
is to 4, the breadth in Feet,

So

So is 12, the length in Feet,
to 5.33, the content in Yards.
Extend the Compaſſes from 9 to 4,
ſame extent will reach (the ſame
y) from 12 to 5.33. that is, to 5
rds and 33 hundred parts of a
rd, which is 3 Yards, one Quar-
r, and almoſt half a Quarter of a
ard.

And what is here ſaid of meaſuring
the Foot, and giving of the Con-
nt in Yards, the ſame may be effe-
ed if the Dimenſions be taken in
eet, and the Reſult required in Ells,
other Meaſure.

CHAP. XII.

Of LAND-MEASURE by the Line.

THE uſual Meaſures for Land are *Chains*, of which there are divers ſorts; but the Denominations

that the quantity of Land is given by, are *Acres* and *Perches*.

The *Chains* now most in use are principally two,

One containing 1 Perch in length, } each of them divided into 100 Links.
The other 4 Perches in length, }

For the Practice of them, take these Examples.

I. *By the One Pole-Chain.*

Example 1. *There is a Plat of Ground 30 Perches broad, and 183 Perches long; how many Perches doth it contain?*

As 1,
to 30, the breadth in Perches;
So 183 the length, in Perches,
to 5490, the Content in Perches.

Extend the Compasses from 1 to 30, that extent shall reach from 183 to 5490, the Content in Perches.

Ex-

xample 2. *But the length and breadth of the ſame piece of Ground being given as before in Perches; if it were required to find the Content in Acres,* Then, the Proportion will be,

As 160 Perches,
to 30 the Breadth, in Perches;
So 183, the Length in Perches,
to 34. 31 Acres.

Extend the Compaſſes from 160 30; the ſame extent will reach the ſame way) from 183 to 34. 31, hat is, 34 Acres, 31 hundred parts f an Acre, which is ſomething above Rood.

II. *By the Four Pole-Chain.*

Example 1. *A Piece of Land containing* 16 *Chains*, 25 *Links in breadth, and* 57 *Chains*, 30 *Links in length, how many Acres doth it contain?* The Analogy is,

As

As 10,
to 16. 25, the breadth in Cha
and Links;
So is 57. 30, the length in Chai
to 93. 11255 Acres, and pa
of an Acre.

Extend the Compaſſes from 10
16. 25, the ſame extent will rea
from 57. 3, to 93. 11255; that
93 Acres, and 11255 parts of
Acre.

Example 2. *The Baſe and Perpendi*
lar of a Triangle being given in Cha
and Links, to find the Content
Acres.

This is a right, uſeful, and neceſſar
Propoſition: for by it all manner o
Irregular Plats of Land are caſt up
But my Intent here is not to teach
Surveying, but to ſhew the uſe of the
Line of Proportion.

Wherefore let the Perpendicular
of a Triangle be 7 Chains 50 Links,
and the Baſe 45 Chains 75 Links, the
Proportion will be,

As

As 2,
to 7. 50, the Perpendicular:
So is 45. 75, the Baſe,
to 17. 15, the content in ſquare Chains.

Extend the Compaſſes from 2, to 7. 50, that extent ſhall reach from 45. 75, to 17. 15, which is 17 Acres, and $\frac{51}{100}$ parts.

Example 3. *Having the length of any Furlong given, to find what breadth it muſt have to make an Acre.*

Let the length of the Furlong be 12 chains 50 links: then to find the breadth for one Acre, this is the Analogy;

As 15. 20, the length in Chains,
is unto 10:
So is 1 Acre,
to 80 links, which muſt be the breadth of the Furlong.

Wherefore

Extend the Compaſſes from 1, in the middle upwards. to 12. 50, the ſame will reach from 1 in the middle, down-

downwards to 80 links, the bread of the Furlong.

CHAP. XIII.

PROB. I

THe Area, *or* Superficial Content *any* Piece *of* Land *being given, according to one kind of* Perch; *To find how much the ſame* Piece *of* Land *would contain, if it were meaſured with a* Pole *or* Perch *of another* Length, *differing from the former.*

Like Plains are in Proportion to another, as are the *Squares* of their *Homologal Sides.* And therefore, the *Proportion* to reſolve this *Problem* is this following, *viz.*

As the *Square* of the *Perch* (*Rod* or *Pole*) by which the *Land* is to be *meaſured*,
Is to the *Square* of the *Pole* or *Perch*, by which it was meaſured,
So is the *Area* (or *Content*) given,
To the *Area* or *Content* required.

Ex-

Example.

Suppoſe a Wood *(or other Piece of* Land*) had been meaſured by a* Chain *of* 18 *Foot, to the* Rood, Pole *or Perch; and by ſuch a* Chain *it was found to contain* 61 Acres, *and* 3 *tenth parts of an* Acre: *and it were required to find how many* Acres *the ſame Piece of* Land *would contain, if it had been meaſured by a* Pole, Rood *or* Perch, *of* 16 *Foot and a half, which is the* Statute, Pole *or* Perch.

The Proportion is,

As the *Square* of 16. 5 Foot, (the *Pole* by which the *Land* is to be meaſured) which is 272. 25,

ſo is to the *Square* of 18 Foot, (the *Pole* or *Perch*, by which the *Land* was meaſured) and is 224;

So is 61. 3 *Acres* (the quantity as meaſured by the 18 Foot *Perch*;)

To 73, (the quantity of *Acres* that it would contain, if it had been meaſured, by a *Statute Pole* of 16. 5 Foot.)

Where-

Wherefore

Extend the Compaſſes from 16. to 18; the ſame extent will reach (the ſame way) from 61. 3 *Acres*, (the Content given;) to another number (*viz.* 6. 63) upon the Line; and from that other Number forward, to 73 Acres, the Content if meaſured by a Statute-Pole of 16. 5 Foot.

But (on the contrary) if the piece being meaſured by a Chain of 16. 5 Foot, ſhould have contained 73 Acres, and it had been required to know how many *Acres* it would have contained, if it had been meaſured by a Chain of 18 Foot to the *Pole*; then, the *Operation* upon the Line would be thus;

Extend the Compaſſes from 18 (downwards) to 16. 5; the ſame extent will reach the ſame way, (*viz.* downwards) from 73 Acres to a Fourth Point (or Number) upon the Line: and from that Point (or Number) downwards to 16. 3 Acres;

And

And ſuch would the quantity of cres have been, if it had been mea-red by a *Cuſtomary Pole* or *Perch* of Foot.

PROB. II.

he Area, *or* Content *of any* Plot *of* Land *being given*; *and the* Scale *by which it was laid down, be either* Omitted, Loſt, *or* Conceal'd; *To find the* Scale *by which it was* Ploted.

Let there be given you the Figure a *Piece of Land*, which is ſaid to ontain 8 Acres, and if you would now by what *Scale* it was laid down, r *Ploted*; do thus;

Firſt take any *Scale* (as ſuppoſe one f 12 Pole in an Inch) and caſt up the Content of the *Plot* thereby; and ſo oing, ſuppoſe you find the ſame *Plot* to contain 11. 5 Acres, that is 1 Acres and a half: and now, to ind the true *Scale* by which it was ploted, this is the *Analogy* or *Pro-portion.*

As

As the quantity of Acres found,
the *Scale* of 12 (*viz.* 11. 5 *A.*)
Is to the *Square* of the *Scale* 12. (
144;)
So is the quantity of *Acres* giv
(*viz.* 8,)
To 105, the *Square* of the *Scale*
which it was plotted, (*viz.* 10,

So,

If you extend the Compaſſes fr
11. 5 Acres, downwards to 8 Ac
The ſame extent will reach from
(downwards) to 10, the *Scale*
which the *Ground* was laid down
plotted.

CHAP. XIV.

Of the Menſuration of divers Regul
SUPERFICIAL FIGURES by t
Line.

HAving ſufficiently ſhewn th
manner of meaſuring of ſuch
Sq

erficial Figures as are measured by gth and breadth, I will now shew how by the Line to measure me other Regular Figures, as the rcle, *&c.*

I. *Of the Circle.*

xample 1. *The length of the* Diameter *of any* Circle *being given, to find the* Circumference *thereof.*

The Proportion between the *Diameter*, and the *Circumference* of any *Circle* is as 7 to 22; or in exacter terms, as 1.000 to 3.14.

Wherefore,

If the Diameter of a Circle be 12 nches, the Circumference thereof may be found by this following Analogy:

As 1.000,
Is to 3.14:
So is 12 the Diameter,
to 37.68, the Circumference.

Where-

Wherefore extend the Comp from 1. 000 to 3. 14, the ſame tent will reach from 12, to 37 ches, 68 parts; which is the Circ ference.

Example 2. *The* Circumference o *Circle being given, to find the le of the* Diameter.

This is the converſe of the for Example, and the Analogy is the verſe alſo.

Let the Circumference of a Ci be 37 Inches, 60 parts, what is length of the Diameter?

As 3. 14,
to 1. 000:
So is 37 Inches, 68 parts, the C cumference,
to 12 Inches, the Diameter.

Extend the Compaſſes from 3. do.vnwards, to 1. 000; the ſame e tent will reach, the ſame way, fro 37. 68, to 12, the Diameter r quired.

nple 3: *Having the* Diameter *a* Circle, *to find the length of the de of a* Square *which ſhall be equal content to the ſame* Circle.

the Diameter of a Circle be 12 es, the Proportion is,

s 1.000,

Is to 12 Inches, the Diameter;

o is 8862,

To 10.63, the Side of the Square.

xtend the Compaſſes from 10000 from 1 in the middle) upwards, 2, the Diameter; the ſame Ex- t will reach from 8862, counted he lower Part of the Line, up- rds, to 10 Inches, 63 hundred ts, the Side of a Square equal in ea to the Circle, whoſe Diameter 2 Inches.

ample 4. *Having the* Circumfe- rence *of a* Circle *given, to find the Side of a* Square *equal to that* Circle.

Let the Circumference of the given rcle be 37 Inches, 68 parts: The oportion is,

As

As 10000,
to 37. 68, the Circumferen
So is 2821
to 10. 63, the ſide of the Squa

Extend the Compaſſes fr
10000 (or 1 in the middle) upwar
to 37. 68, the ſame extent will rea
from 2821 upwards, to 10 Inches,
parts, the ſide of the Square require

Example 5. *The* Diameter *of a* C
cle *being given, to find the* Super
cial Content *thereof.*

Let the Diameter of a Circle be
Inches.

Extend the Compaſſes from 1
15, the Diameter; then apply on
Foot of that diſtance (always) to 78
54: and turn that diſtance twice fro
this Number, the ſame way, and th
Compaſs-point will fall upon 17
Inches, 74 parts; which is the *Ar*
of that Circle whoſe Diameter is 1
Inches.

Ex-

mple 6. *The Circumference of a ircle being given, to find the Area ereof.*

et the Circumference of a Circle n be 47 Inches, 13 parts.

xtend the Compaſſes from 1, to 13, the Circumference; this di- ce being applied (always) to this mber 7958, and from thence twice eated, the Point of the Compaſſes he ſecond remove, will fall upon 6 Inches, 74 parts, equal to the A- of the Circle, as before.

re note, That your Compaſſes being opened from 1 to 37. 13, the Cir- cumference, when you come to ſet one Foot upon 7958, the other will reach at your firſt turning over to 29. 55; and when you turn them over again, it will fall out of the Line: wherefore you muſt ſet one Foot in 29. 55, in the lower part of the line, and then the other will fall upon 176. 74; and this you muſt do in other caſes,

caſes, whenever your Compa
point goes beyond your Line.

CHAP. XV.

II. *Of the* TRIANGLE.

A *Triangle* is a Figure conſiſtin
of three *Sides* and three *A*
gles, the longeſt *Side* whereof we ca
the *Baſe*; and a Line drawn from th
Angle oppoſite to the *Baſe*, we ca
the *Perpendicular*.

To meaſure *Triangles* there ar
ſeveral ways; I will only ſhew yo
one or two to be done by the Line.

Example 1. *There is a* Triangle *whoſe* Baſe *is* 14 *Foot, and his* Perpendicular 6 *Foot; I would know how many ſquare Feet is contained in this* Triangle.

The Proportion is,

1. As

As 2,
is to 6, the Perpendicular;
is 14, the Baſe,
to 42, the Area.

Or,

As 1,
is to 3, half the Baſe;
is 14, the Baſe,
to 42, the Area.

Or,

As 2,
is to 6, the Perpendicular;
is 7, half the Baſe,
to 42, the Area.

Or,

As 1,
is to 6, the Perpendicular;
is 14, the Baſe,
to 84, the double Area.

All theſe Ways produce the ſame Effect; but the firſt is the beſt:

Wherefore,

The *Baſe* of your Triangle being 14, and the *Perpendicular* 6,

For the First way,

Extend the Compasses from 2
6; the same Extent will reach fr
14, to 42, the Area.

For the Second way,

Extend the Compasses from 1
3; the same Extent will reach fr
14, to 42.

For the Third way,

Extend the Compasses from 2
6; the same Extent will reach fr
7, to 42.

For the Fourth way,

Extend the Compasses from 1
6; the same Extent will reach fr
14, to 84; which is the double of
the Area.

III. *Of the* Trapezia.

A *Trapezia* is any right lined F
gure consisting of four unequal Side
and as many unequal Angles.

For the measuring of it, you mu
first reduce it into two *Triangles*, b
draw

wing a Line or *Diagonal* from one
poſite *Angle* to another, the long-
way; then from the two *Angles*
poſite to this *Line*, let fall two
pendiculars; ſo is the *Trapezia* di-
ed into two *Triangles*. The man-
how to meaſure it, is as fol-
veth.

ample. *There is a* Trapezia, *whoſe* Diagonal *is* 12. 34, *and one* Perpendicular *is* 4. 20, *the other* 5. 70; *I would know the Content or* Area *thereof*.

The two Perpendiculars added together, make 9. 27. Then the Analogy is,

As 2,
is to 9. 27, the Sum of the Perpendiculars;
So is 12. 34, the Baſe or Diagonal,
to 57. 17, the Area.

Extend the Compaſſes from 2, to 9. 27; the ſame Extent will reach (the ſame way) from 12. 34, to 57. 17,

17, which is the Area, or Superfi
al Content of the *Trapezia*.

There are as many ways to m
ſure *Trapezia's*, as in the laſt Exa
ple I gave you for *Triangles*; b
this is the beſt.

And here note, That if you are
meaſure any irregular Piece, of wh
nature ſoever, whether *Land*, *Boa*
Glaſs, *Pavement*, or the like, yo
beſt and exacteſt way is to redu
them to *Trapezia's*, and meaſure the
as before is taught.

IV. *Of* Regular Figures *of* 5, 6, 10, *or* 20 *equal Sides.*

Theſe Figures by Geometricia
are called *Regular Polygons*; and t
way to meaſure them, is by addi
all the Sides together: Then meaſu
the length from the Centre of t
Figure, to the middle of one of t
Sides. By the help of theſe two yo
may find the Area of the Figure: a
followeth. Exam

ample. *Let there be a* Regular Polygon *of* 11 *equal Sides, each Side being* 7 *Inches, and let the length of the Line from the* Centre, *to the middle of one of thoſe Sides, be* 12 *Inches.*

Add all the Sides together, they make 77; then,

As 2,
is to 77, the Sum of the Sides;
So is 12 Inches, the length of the Line from the middle of the *Figure,*
to 462, the Content of the Figure.

Extend the Compaſſes, from 2, in the under part of the Line, to 77, (counted alſo in the under part of the Line:) The ſame Extent will reach from 12 (counted in the upper-part of the Line) to 462, which is the true Content of the *Polygon* in Feet.

CHAP. XVI.

The Uſe of the LINE *applied to S* LID MEASURE, *ſuch* Timber, Stone, *&c.*

TImber and Stone are uſua meaſured by the ſame *Rule Meaſure* as *Board* and *Glaſs* a namely, by *Feet* and *Inches:* Ther fore ſuch a Rule as was mentioned the beginning of the *Tenth Chapt* is fit for this Buſineſs alſo.

Before we come to ſhew the wa of Meaſuring of *Stone* or *Timber*, will be neceſſary to premiſe thu much; That the *Baſe* or *End* of ever picce of *Timber* or *Stone* is (or mu be ſuppoſed) either exactly ſquare that is, every Side alike, or elſe on of the Sides longer than the other wherefore the firſt thing to be done is to find the *Area*, or *Superficia* conte

ontent of the *Baſe*, or end of any iece of *Timber* or *Stone* to be mea-ured; which may be done ſeveral ways, either in Inch-meaſure, as by e firſt *Example* of the firſt part of e *Tenth Chapter*; or in *Foot-meaſure*, y the firſt *Example* in the ſecond art of the ſame *Chapter*; or both in *oot-meaſure* and *Inch-meaſure*, as in he firſt *Example* of the third part of he ſame *Tenth Chapter*, and there-fore need not be here repeated again: Wherefore, we will proceed to our intended purpoſe of *Meaſuring*, firſt, by *Inch-meaſure* only; ſecondly, by *Foot-meaſure* only; and thirdly, by both together: as we did before in the *Meaſuring of Board*, &c.

I. In Inch-meaſure only.

Example 1. *There is a piece of* Timb
30 *Inches broad*, 21 *Inches*, 6 *p*
deep, and 183 *Inches long; how ma*
ſquare Inches is there in this ſol
piece of Timber?

The Proportion is,

1. As 1,
is to 30 Inches the Breadth;
So is 21. 6 Inches, the Depth,
to 648 Inches, the Content of th
Baſe of the piece.

2. As 1,
is to 648, the Content of the Baſe;
So is 183 Inches, the length of the
piece,
to 118584, the ſolid Content in
Inches.

Wherefore, Extend the Compaſſes from 1, to 30, the breadth; the ſame will reach from 21. 6, the depth, to 648, the Content of the Baſe.——

Again,

Again, Extend the Compaſſes from to 648, the Content of the Baſe; at extent will reach from 183, the ngth, to 118584 Inches, the ſolid ontent. But ſo many places of Fi-res can't well be eſtimated upon ur Line, except it be very large; t by the following Examples you all have your deſire accompliſhed exactly and eaſily.

Example 2. *To find the Content of the ſame piece of* Timber *in* Foot-meaſure, *the Dimenſions being given in* Inches *and Parts?*

The Proportion is,

1. As 1,
is to 30, the Breadth;
So is 21. 6, the Depth,
to 648, the Content of the Baſe, as before.

2. As 1728, the number of ſolid Inches in a Foot of Timber,
is to 648, the Content of the Baſe;
So is 183, the length in Inches,
to 68 Foot, and 42 parts of a Foot, as before.

Wherefore, as before, Extend
Compaſſes, from 1, to 30, the Brea
the ſame will reach from 21. 6,
Depth, to 648, the Content of
Baſe, as before.——

Again, Extend the Compaſſes fr
1728, (calling the 1 in the middle
the Line 1000) downwards to 6
the Baſe (counted in the under-p
of the Line:) The ſame Extent w
reach the ſame way, from 183, t
length (counted in the upper-part
the Line) downwards, to 68. 62, t
Content of the piece of Timber
Feet and parts, that is, 68 Foot, a
above half a Foot.

Example 3. *Let a ſquare* Stone, *
piece of* Timber *be* 30 *Inches bro
and* 21 *Inches*, 6 *parts deep*; *h
much in length ſhall make a F
ſquare of that piece of* Timber
Stone?

You may find the Content of t
Baſe, as in the laſt Example, to
648 Inches: Then the Proportion

As 648, the Content of the Baſe,
is to 1728, the Inches in a Foot,
So is 1,
to 2 Inches, 67 Parts, the length of a Foot ſolid.

Therefore extend the Compaſſes from 648, the Baſe, to 1728; the ſame will reach from 1, to 2. 67: So that 2 Inches, 67 Parts, will make a Foot ſolid of that piece of Timber or Stone.

This may be done another way, by this Analogy or Proportion.

1. As 12,
is to 30, the Breadth in Inches,
So is 21. 6, the Depth in Inches,
to a fourth Number (which here will be about 54.)

2. As the fourth Number 54,
is to 144;
So is 1,
to 2. 67, the length of a Foot ſolid.

Wherefore, Extend the Compaſſes from 12, to 30, the breadth, that Extent

tent will reach from 21.6, the dep
to a cerrain place upon the Line
bout 54) where keep the Point of
Compaſs faſt, and open the other
144; then will this Extent of
Compaſſes reach from 1, to 2 Inch
67 parts, the length of a Foot ſol
as before.

II. *In Foot-meaſure only.*

Example 1. *Let a* Stone *or a piec*
Timber *be* 2 *Foot*, 50 *parts broad*,
Foot, 80 *parts deep*, *and* 25 *Foot*,
parts long, *how many ſolid or cubi*
Feet doth ſuch a piece contain?

The Proportion is,

1. As 1,
is to 2. 50 Foot, the Breadth:
So is 1. 80 Foot, the Depth,
to 4. 50 Foot, the Baſe in Foot
meaſure.

2. As 1,
is to 4. 50, the Baſe;
So is 15. 25, the Length,
to 68. 62, the Content in Feet.

Ex.

Example 2. *In the forementioned piece of ſquared Stone or Timber, being 2 Foot, 50 parts broad, and 1 Foot, 80 parts deep, Let it be required to find how much thereof in Length will make a Foot.*

The Proportion is,

1. As 1,
is to 2. 50, the Breadth;
So is 1. 80, the Depth,
to 4. 50, the Content of the Baſe in Foot-meaſure.

2. As 4. 50, the Baſe,
is to 1,
So is 1 Foot,
to 222 parts, the Length of a Foot ſolid.

Wherefore, Extend the Compaſſes from 1, at the beginning of the Line, to 2. 50, the breadth; the ſame Extent will reach from 1. 80, the depth in the under-part of the Line, to 4. 50, the Content of the Baſe.——

Again, Extend the Compaſſes from 4. 50, the Baſe, ſcounted in the upper

per-part of the Line) downwards
1. in the middle of the Line; t
ſame will reach from 10, at the end
the Line, downwards, to 222 par
the Length of a *Cubical* or *Solid F*
of that *Stone* or Piece *of Timber*.

III. *In FOOT-MEASURE an*
INCH-MEASURE together.

Example. *Let a ſquared Stone or piec*
of Timber be 30 *Inches broad*, 27.
Inches deep, and 15 *Foot*, 25 *part*
long; *How many* Cubical *or* Solid
Foot of Stone or Timber, is there in
that Piece?

The Proportion is,

1. As 1,
is to 30 Inches, the Breadth;
So is 21. 6 Inches, the Depth,
to 640, the Content of the Baſe in
Inches.

2. As

2. As 144. the Inches in a Foot Superficial,
Is to 648, the Content of the Baſe in Inches:
So is 15. 25, the Length of the Piece in Foot-meaſure,
to 68 Foot, 62 Parts.

Wherefore Extend the Compaſſes from 1 to 30, the Breadth: the ſame will reach from 21. 9, the depth, to 648, the Content of the Baſe.——

Again, Extend the Compaſſes from 144, to 648, the Content of the Baſe; the ſame Extent will reach from 15. 25, the length of the piece, to 68. 62, the ſolid Content of the Stone or Timber in Feet, and 100 parts of a Foot.

By having the ſame things given in the ſame piece of Stone or Timber (or in any other) the Work may be varied ſeveral ways: The Analogies or Proportions I will only give you, leaving the Practice thereof to your ſelf.

Breadth

Breadth of the Piece, 30 Inches.
Depth of the Piece, 21. 6 Inches.
Length of the Piece, 15. 25 Foot.

The Proportion is,

1. As 144,
is to 30, the Breadth:
So is 21 .6, the Depth,
to a fourth Number.

From which fourth Number, if you extend your Compasses to 1, and place one Foot in 15. 25, the length of the Piece, the other Foot shall fall upon 68. 62, the Content of the Stone.

Or,

2. As 12,
is to 30, the Breadth;
So is 12. 6, the Depth,
to some fourth Number.

From this fourth Number extend the Compasses to 12, that distance will reach from 15. 25, the length of the Piece, to 68. 62, the Content of that Piece.

CHAP.

CHAP. XVII.

How to measure Stone *or* Timber *by the Line, by having the* Square *of the* Base, *and the* Length *of the Piece given, both in* Foot *and* Inch-measure.

HOW to find the Length of a Side of a *Geometrical Square*, that shall be equal to any *Parallelogram*, or *Long-Square*, is taught at the latter end of the Tenth Chapter of this Book, by which Rule it may at any Time be found. That being done there, I shall only here begin with Examples.

Example 1. *There is a squared Piece of Timber, whose Length is* 183. *Inches, and the side of the Square, equal to the Base or End thereof, is* 25 *Inches,* 45 *Parts; how many Foot doth that piece contain?*

1. As

1. As 41. 57,
is to 25. 45, the side of the Squa
So is 183, the Length in Inches,
to a fourth Number:
2. And that fourth Number,
to 68. 82, the Content in Feet.

Extend the Compasses from 41.
to 25. 45, the side of the Square;
same will reach from 183, the leng
to some other part of the Line; fr
whence if you again extend the sa
distance, the Point will rest upon
Foot, 62 parts of a Foot; and so
ny Foot is in the Piece

Example 2. *Let the side of a Squa
equal to the Base of a piece of Stone
Timber, be* 2 *Foot*, 12 *parts, and
length of the same Piece* 15 *Foot,
parts; how many solid Foot is th
in that Piece?*

1. As 1,
is to 2 Foot, 12 Parts, the side of t
Square;
So is 15 Foot, 25 parts, the length
to a fourth Number:

2. A

And that fourth Number,
to 68. 62, the Content in Feet.

Extend the Compaſſes from 1, in the middle, upwards, to 2. 12, the ſide of the Square; that will reach from 15. 25, the length, to ſome other Number on the Line: from whence the Compaſſes being extended (or turned upwards) the moveable Point will fall upon 68. 62, the Content, as before.

Example 3. *The ſide of a Square, equal to the Baſe of a Stone, being* 25 *Inches,* 45 *parts, and the length of that Stone* 15 *Foot,* 25 *parts, how many Foot doth it contain?*

1. As 12,
is to 25. 45, the Square in Inches:
So is 15. 25 Foot, the length,
to a fourth Number:

2. And that fourth Number,
to 68. 62, the Content.

Extend the Compaſſes from 12, to 25. 45, the ſide of the Square; the ſame will reach from 15. 25, to ſome other

other point upon the Line, fr
whence the Compasses being exte
ed or turned upwards, the move
Point will fall upon 68 Foot, 62 pa
the Content of the Stone.

Example 4. *There is a piece of Tim
whose side of the Square of the E
is 25 Inches, 45 parts, how much
length of that Piece will make a F
solid?*

1. As 25. 45, the side of the Squa
is to 1 Foot;

So is 41. 57,
to a fourth Number.

2. And that fourth Number,
to 6 Inches, 67 parts.

Wherefore, Extend the Compas
from 25. 45, the side, downwards,
1 in the middle of the Line; the sam
will reach from 41. 57, downwards t
some other Point, from whence th
Compasses being turned still down
wards, will reach to 6. 67, the leng
of a Foot solid of that Piece of Tim
ber.

Ex

mple 5. *The length of the ſide of a quare, equal to the Baſe of a piece f Timber, being 2 Foot, 12 parts, to nd how much in length of that piece will make a Foot ſolid in Foot-meaſure.*

2. 12, the ſide of the Square,
is to 1. 00;
is 1. 00,
to a fourth Number.

And that fourth Number,
to 222 parts of a Foot, to make a Foot ſquare,

Extend the Compaſſes from 2. 12, he ſide of the Square, downwards to 00; the ſame extent will reach from 00, downwards to ſome other Point pon the Line, and from thence ſtill ownwards, to 222 parts of a Foot; nd ſo much in length will make a oot ſolid.

CHAP.

CHAP. XVIII.

Concerning Timber *that is bigger at one end than at the other, either* Round *or* Square; *and how to meaſure it.*

I. *For* SQUARED TIMBER.

IN large Timber-Trees, when they are ſquared, there is a great diſproportion between the Squares of both ends; wherefore ſome do uſe to take the ſquare of the middle of the Piece for the mean or true ſquare; but this is not exact, though much uſed; but the beſt way is this: Find by the Problem at the end of the Tenth Chapter of this Book, the length of the ſide of a Square equal to both the ends of the Piece, add theſe two ſides together, and take the half thereof for the true Square; and

with that Square you may by Rules of the laſt Chapter meaſure as if it were perfectly ſquare.

But this way is not exact neither: it is not the Arithmetical Mean, the Geometrical Mean, which es the true ſquare: as by the Sup- ment at the end of the Tenth apter you may ſee.

II. *For* ROUND-TIMBER.

The ordinary way uſed for the eaſuring of Round-Timber, is to t it about the middle with a Line, d to take one fourth part thereof r the ſide of a Square equal there- : but this is falſe, though moſt en uſe it, Cuſtom having made it ar the face of Truth: for it is ore in meaſure than in reality it ould be, by about one fifth part.

But the exact way of meaſuring of ound Timber (eſpecially if it be rowing) is this: About the midſt thereof,

thereof, in ſome ſmooth place, girt
ſame about with a String: Then h
you this Proportion;

As 1000,
is to the number of Inches abo
So is 2821,
to the length of the ſide o
Square equal thereunto.

So if a Tree being girt about,
aboveſaid, ſhall contain in circum
rence 47 Inches, 13 parts.

If you extend the Compaſſes fr
1000 to 47 Inches, 13 parts, the ſa
extent will reach from 2821, to
Inches, 29 parts, which is equal to t
ſide of a Square equal to that Tre
which being obtained, the Tree m
be meaſured divers ways, accordi
to the Examples in the laſt Chapt

CHA

CHAP. XIX.

erning the meaſuring of Regular olids, or Cylinders, Globes, Cones, nd ſuch like.

I. *Of the CYLINDER.*

A *Cylinder* is a round Figure, of equal Circumference in all ts thereof, as a ſtanding Pillar, a wling-ſtone for Garden-walks, *&c.* meaſure ſuch a Figure there are eral ways, both by having the Cir- nference given when it is ſtanding, by having the Diameter at the end reof when it is lying, or by having ſide of a Square equal to the Baſe reof.

I. *By having the Diameter given.*

Example 1. *The Diameter being* [illegible] *Inches, how much in length* [illegible] *a Foot?*

As 15, the Diameter,
to 46. 90:
So is 1,
to a fourth;
And that fourth,
to 9. 78, the length of a Foot.

Extend the Compaſſes from [illegible] the Diameter, to 46. 90: that extent will reach from 1, to another Point upon the Line, and from thence to 9 inches, 78 parts, the length of a Foot ſolid.

Example 2. *The Diameter being* 1 [illegible] *25 parts, how much in length* [illegible] *a Foot in Foot-meaſure.*

As 1. 25, the Diameter in Feet,
to 1. 128:
So 1,
to a fourth Number;
And that,
to 8. 14, the length of a Foot
solid in Foot-measure.

Extend the Compasses from 1. 25,
the Diameter, to 1, 128; the same
will reach from 1, to some other
number, and from thence to 1 Foot,
8 parts of a Foot, the length of a
foot solid.

Example 3. *Having the Diameter*, 15 *Inches, and the length*, 105 *Inches*; *How many solid Inches doth the Cylinder contain?*

As 1. 128,
to 15 Inches, the Diameter;
so is 105 Inches, the length,
to a fourth Number;
And that,
to 18555. 34 Inches, the content.

Extend the Compaſſes from 1.1
to 15, the length: the ſame exte
will reach from 105, the length,
ſome other Number, and from the
to 18555. 34 inches, the Content
the Cylinder in inches.

Example 4. *Having the Diameter*
Foot, 25 parts, and the length 8 F
75 parts, to find the Content in F

As 1. 128,
to 1. 25, the Diameter:
So is 8. 75, the length,
to a fourth;
And that fourth,
to 10. 74 Foot, the content.

Extend the Compaſſes from 1. 12
to 1. 25, the Diameter: the exte
will reach from 8. 75, the length,
ſome other Number, and from th
to 10 Foot, 74 parts, the content.

Example 5. *Having the Diameter*
Inches, and the length 105 *Inches,* h
many Foot doth it contain?

46. 90,
o 15 Inches, the Diameter;
is 105 Inches, the length,
o a fourth:
d that fourth,
o 10 Foot, 74 parts, the content.
Extend the Compaſſes from 46.90,
15, the Diameter: that extent will
ch from 105 the length, to another
mber, and from that to 10 Foot,
parts, the content.

xample 6. *The Diameter being* 15 *Inches, and the length* 8 *Foot,* 75 *parts, how many Foot doth it contain?*

s 13. 54,
to 15 Inches, the Diameter:
8. 75 Foot, the length,
to a fourth:
nd that fourth,
to 10. 74, the length in Feet.
Extend the Compaſſes from 3. 54,
15, the length: that Extent will
each from 8. 75, the length, to ano-
ner Number, and from thence to

10. 74 Foot, the Content in Feet.

II. *By having the Circumference given.*

Example 1. *The Circumference of a Cylinder is* 47 *Inches*, 13 *parts*; *how much thereof in length ſhall make a Foot ſolid?*

As 47. 13 Inches, the Circumference
to 147. 36:
So 1,
to a fourth Number:
And that,
to 9. 78 Inches, the length of a Foot.

Extend the Compaſſes from 47. 13 the Circumference, to 147. 36: that extent will reach from 1, to a fourth Number, and from thence to 9 Inches 78 parts, the length of a foot ſolid.

Example 2. *Having the Circumference of a Cylinder*, 3 *Foot*, 927 *parts*, *to find the length of a Foot ſolid thereof in Foot-meaſure.*

As

s 3. 927 Foot,
to 3. 545 :
o 1,
to a fourth Number :
nd that,
to 815 parts of a Foot, the length.
Extend the Compaſſes from 3.927,
he Circumference, to 3. 545 : that
xtent will reach from 1, to ſome
ther Number, and from thence to
15 parts of a Foot, for the length of
ſolid Foot of that Cylinder.

Example 3. *The Circumference of a Cylinder being* 47 *Inches*, 13 *parts, and the length thereof* 105 *Inches, How many inches is there in ſuch a Cylinder ?*

As 3. 545,
to 47. 13, the Circumference ;
So 105 Inches, the length,
to a fourth Number :
And that,
to 18555, the Content in Inches.

Extend the Compaſſes from 3.5
to 47.13, the Circumference; that
tent will reach from 105, the leng
to another Number; and from the
to 18555, the number of ſolid inch
in the Cylinder.

Example 4. *The Circumference bei*
47 Inches, 13 parts, and the leng
105 Inches (as before); How ma
ſolid Foot in that Cylinder?

As 147. 36,
to 47. 13 Inches, the Circumf
rence;
So 105 inches, the length,
to a fourth Number:
And that,
to 10 Foot, 74 parts, the Conten

Extend the Compaſſes from 14
36, to 47. 13, the Circumference, tha
extent will reach from 105, th
length, to another Number; an
from that, to 10 Foot, 74 parts of
Foot, the ſolid Content.

Ex-

xample 5. *Let the length of the Cylinder be* 8 *Foot*, 75 *parts, and the Circumference* 3 *Foot* 927 *parts: How many Foot doth it contain?*

s 3. 545,
to 3. 927 Foot, the Circumference:
o 8. 75 Foot, the length,
to a fourth Number:
nd that,
to 10 Foot, 74 parts, the Content.
Extend the Compasses from 3.545,
o 3.927: the same extent will reach
om 8. 75, the length, to 10. 74, the
ontent in Feet.

Example 6. *Let the Circumference given be* 47 *Inches*, 13 *parts, and the length* 8 *Foot*, 75 *parts: How many solid Feet doth the Cylinder contain?*

As 42. 54,
to 47. 13 Inches, the Circumference:
So is 8. 75 Foot, the length,
to a fourth:
And that fourth,
to 10. 74 Foot, the Content.

Extend the Compasses from 42.5 to 47.13, the Circumference: that extent will reach from 8.75, the length to another Number, and from thence to 10 Foot, 74 parts, the Content of the Cylinder in solid Feet.

III. *By having the Side of a Square equal to the Base or End of a Cylinder.*

Example. *Let the Side of a Square equal to the Base or End of the Cylinder, be* 13 *Inches*, 29 *parts, and the length thereof* 105 *Inches; How many square Feet are contained in that Cylinder?*

As

As 41 · 57,
to 13. 29 Inches, the Side of the Square:
So is 105, the length in Inches,
to a fourth Number:
And that,
to 10 Foot, 47 parts, the Content of the Cylinder in Feet and parts.

Extend the Compasses from 41.54, to 13. 29 Inches, the side of a Square equal to the Base of the Cylinder; that extent will reach from 105 Inches, the length, to another Number, and from thence, to 10 Foot 47 parts, the Content of the Cylinder in Feet.

II. *Of the* CONE.

A *Cone* is a round Figure, having for the Base thereof a Circle, the Side whereof riseth from the Circumference of the Circle round about the same equally, till it meet in a point just over the Center of the Circle, and

and is in the form of a Spire-ſteeple: And it is thus meaſured.

Example 1. *Let there be a Cone, the Diameter of whoſe Baſe is* 10 *Inches, and whoſe Height is* 12 *Inches, I would know how many ſolid or Cubical Inches are contained therein.*

The Diameter being 10, the Content of the Circle or Baſe will be found to be 78 Inches, 54 parts, as by the fifth Example in Chap. 13. of this Book.

The Area of the Baſe being thus found, the Proportion is,

As 3,
to 78. 54 Inches, the Content of the Baſe:
So is 14 Inches, the Height,
to 314 Inches, 16 parts of an Inch, for the Content of the Cone in Inches.

Extend the Compaſſes from 3, to 78. 54, the Baſe: that extent will reach from 12 the height, to 314 Inches, 16 parts, the Content of the Cone in ſolid Inches.

Ex-

xample 2. *Let the Diameter of the Baſe be* 12 *Inches, as before, and the length of the Side be* 13 *Inches: How many ſolid Inches is there in this Cone?*

Extend the Compaſſes from 1, to 5 Inches, half the Diameter of the Baſe; that extent will reach from 5, to 25.

Extend the Compaſſes from 1, to 13, the length of the Side: that extent will reach from 13, to 169.

From this 169, take the 25 before found, and there remains 144.

Upon your Line take half the diſtance between 1 and 144, and you ſhall find it to be 12: which 12 is the height of the Cone: So the height being had, you may find the Content, as in the laſt Example.

III. *Of SPHERICAL BODIES.*

A Spherical Body is ſuch a Body whoſe Superficies in all the parts of it are equally diſtant from the Centre of the Body, as *Globes*, *Bullets*, &c.

Example

Example 1. *The Circumference of a* Globe *or* Bullet, *being* 28 *Inches,* 2[illegible] *parts, to find the length of the Diameter.*

As 22,
to 7:
So is 28. 28, the Circumference,
to 9 Inches, the Diameter.

Extend the Compaſſes from 22 downwards to 7: the ſame extent will reach from 28. 28, the Circumference downwards to 9 Inches, the length of the *Diameter* of that *Bullet*.

Example 2. *The Diameter of a Spherical Body being given in* 9 *Inches, and its Circumference is* 28 *Inches,* 28 *parts: How many ſquare Inches, is there in the Superficies of that Spherical Body?*

As

As 1,
is to 9 Inches, the Diameter,
So is 28.28 Inches, the Circumference,
to 244. 5 Inches, the ſuperficial content.

Extend the Compaſſes from 1 to 9, the Diameter: the ſame extent will reach from 28,21, the Circumference, to 254 Inches, 5 parts, the ſuperficial Inches in this ſpherical Body.

Example 3. *The Diameter of a Spherical Body being 9 Inches, how many ſolid Inches are therein contain'd?*

1. As 1,
is to 9, the Diameter:
So is 9,
to a fourth Number:
And that fourth Number,
to 729, the Cube of the Diameter.

2. As

2. As 9, the Diameter,
to 729, its Cube:
So is 11,
to 891 Inches, the ſolid Content of the Spherical Body.

Extend the Compaſſes from 1, to 9, that extent will reach from 9 to 81, and from 81 to 729, the Cube of the Diameter. —— Then extend the Compaſſes from 9, the Diameter, to 729 its Cube: that extent will reach from 11, to 891 Inches, the ſolid Content of the ſpherical Body.

I might here add the manner how to meaſure other kind of Bodies, both Regular and Irregular; as *Ellipſes*, *Parabola's*, &c. Alſo of *Priſms*, *Scalenes*, *Cones*, *Spheroïades*, &c. But theſe being out of the reach of ordinary Artificers, for whoſe ſakes this Treatiſe was chiefly compoſed, I ſhall here conclude this Treatiſe of the Uſe of the Line of Proportion, with a ſhort Supplement of Gauging of Veſſels.

CHAP.

SUPPLEMENT.

CHAP. XX.

Concerning Gauging of Veſſels by the Line.

BEfore you can meaſure your Veſſel, to find the Content thereof Gallons or Parts, you muſt find e Content thereof in Inches; and effect this, you muſt find the ontent of two third parts of a Cirle, agreeable to the Diameter at the ung: and one third part of another Circle, agreeable to that of the Diameter at the Heads; theſe two added together, and multiplied by the ength of the Veſſel, that product will e the Content of that Veſſel in Inches.

EX-

EXAMPLE.

Let there be a Veſſel whoſe { *Dia. at Head*, 18 / *Dia. at Bung*, 32 / *Length is* 40 } *Inches*

And let the Content *thereof, firſt* Inches, *and then in* Gallons, *be required.*

I. *For the two third parts of the* Circle *at the* Bung.

As 1,
to this univerſal number [5236
So 1024, the ſquare of the Diameter at the Bung 32,
To 536.166 Inches, which is two third parts of the Content of the Circle at the Bung.

Wherefore, Extend the Compaſſes from 1, to 5236, the ſame extent will reach from 1024 (the ſquare of 32 the Diameter at the Bung) to 536.166 Inches, the Content of two third parts of the Circle at the Bung in Inches.

II. *For*

For one third part of the Circle at the Head.

s 1,
to this general Number [2618:]
is 324, the Square of the Diame-
ter at the Head 18,
84. 823 Inches, which is one
third part of the Content of the
Circle at the Head.

Wherefore, Extend the Compasses
om 1, to 2618; the same extent will
each from 324 (the Square of 18, the
iameter at the Head) to 84. 823 In-
hes, the Content of one third part of
he Diameter at the Head in Inches.

III. *For*

III. *For the Number of ſquare Inches in the Veſſel.*

Add theſe two Numbers--536. 16
and-- 84. 82

They make --620. 98

Which multiplied by 40, the length of the Veſſel, produceth ——— 24839. 5

And ſo many ſquare Inches a contained in ſuch a Veſſel, whoſe D ameter at the *Head* is 18 Inches, at t *Bung* 32 Inches, and is 40 Inch long.

IV. *F*

IV. *For the Content in Wine or Ale Gallons.*

Divide this Num- } 231 for Wine,
r 24839. 56, by--- } 282 for Ale,
d the Quotients ſhall tell you the
mber of Gallons and parts of a
llon.

Wine *gall.* *parts.*

231) 24839. 56 (107. 52
... ..

231

1739

1617
1225

1155
706

693
13

Ale-

Ale. *gall. parts.*

282) 24839. 56 (88. 08

2256

2279

2256

2356

2256

100

By this Work you may perceive that this Veſſel containeth. { 107 Gallons, 5 parts, of Wine measure. / 88 Gallons, o parts, of Ale measure.

How to multiply and divide by th Line, is taught in the Secon and Third Chapters of this Book and therefore it were needle here to repeat it again: But

cho

ose rather to do it Arithmetical-
for the better Illustration, and
the Satisfaction of such as have a
light in Numbers.

More, concerning Gauging by the Line.

All Close Casks or Vessels, are
ar to one or other of these Forms;
z. *Cylindrical*, *Spheroidical*, *Para-*
lical, *Conodial*, or *Conical*: Every
which, (before it can be Gauged)
ust be reduced to the *Cylindrical*
rm: by finding out of a *Mean Dia-*
eter, between the *Diameters* of the
ead and *Bung* of the Vessel; For
e effecting whereof, for most Or-
inary Casks, the following directi-
n is a ready

RULE.

RULE.

As 10, is to 7,
So is the Difference of the Diame
ters of the Head and Bung of th
Cask;
To a Number; which added to th
Leſſer Diameter, of the Cas
ſhall give you the *Mean Diamet*
for that Cask.

EXAMPLE.

Let the *Diameter* at the *Head*, b
18 Inches; at the *Bung* 32: the
Difference is 14: And let the *Me*
Diameter be required:

Extend the Compaſſes from 1
to 7; the ſame extent will reac
(the ſame way) from 14, the Diff
rence, to 9. 8 Inches, which adde
to 18 Inches, the leſſer Diameter
gives the *Mean Diameter* for tha
Cask, to be 27. 8 Inches.

Bu

But if the *Cask* be near a *Cylindri-* Form, you may take the Proportion to be ; As 10 to 8.

But if near to a *Conical* Form, then the Proportion may be as 10 5. 30.

Or, If it be in a *Parabolical* or *al* Form, then the Proportion y be taken to be, As 10 to 6.

And for *Casks* whoſe *Staves* ell out very much, you may uſe eſe ſeveral Proportions, as you d them to tend more or leſs *erical*, viz.

10, to $\left\{\begin{matrix}7.\ 3\\7.\ 4\\7.\ 5\end{matrix}\right\}$ ſo the difference

a Fourth Number ; which added to the leſſer Diameter, will give you the *Mean Diameter* proper for that *Cask*.

The *Mean Diameter* being th
found, the *Area* of the Circle ma
be found as in Chapter XIII. O
by this Proportion:

As 10,
Is to the *Mean Diameter*:
So is 78. 54, (always)
To the *Area* of the *Circle*.

EXAMPLE.

So the *Mean Diameter* bei
27. 8 Inches,
Extend the Compaſſes from 1
to 27. 8 (the *Mean Diameter*) t
ſame extent will reach (the ſa
way) from 78. 54: To 218. 3, a
from thence to 621;
And that is the *Area* of that *Cir*
in *Square Inches*. And,
This *Area* being found, the *Co*
tent of the *Cask* may be found
this Proportion.

As 1,
Is to the *Area* of the *Circle* in Inches;
So is the length of the *Cask* in Inches,
To the Content thereof in ſolid Inches.

EXAMPLE.

So, the *Area* of the Circle being 21 Inches; and the length of the Cask 40 Inches.

Extend the Compaſſes from 1, to 621, the *Area* of the *Circle* in Inches, the ſame extent will reach (the ſame way) from 40, (the length of the *Cask* in Inches) to 25000 Inches; for the *Content* of the *Cask* in ſolid Inches.

And this being known, the *Content* in *Wine* or *Ale Gallons* may be found by this Proportion.

As 231 (for Wine;) or 282 (fo
Ale;)
Is to 1;
So is the Content of the *Cask* i
ſolid Inches;
To the *Content* in *Gallons*.

EXAMPLE.

So, The *Content* of the *Cask* i
ſolid Inches being 25000.

Extend the Compaſſes from 23
(for *Wine*) downwards to 1; th
ſame extent will reach (the ſam
way) from 25000 (the ſolid Inche
in the Cask) to 107. 5.

And ſo many *Wine-Gallons* dot
that Cask contain.

Or,

Extend the Compaſſes from 282, or *Ale*) downwards, to 1; the ne extent will reach the ſame ay, from 25000; to 88:
And ſo many *Ale-Gallons* doth the ask contain.

How to measure

Board, Glaſs, Timber Stone, &c.

BY

A Line of Equal Parts,

Drawn from the Centre of a

Two-Foot Joint-Rule

ALL Proportions that may be wrought upon a ſtraight Ruler by the Line of Proportion or Numbers, the ſame may be wrought by a Line of Equal Parts, drawn from the Centre of an Opening Joint.

And whereas this Line of Equal Parts is numbred from the Centre of

e Rule towards the end thereof, by 2, 3, 4, &c. to 10; that theſe gures (as in the other Line) do metimes ſignifie themſelves only, metimes 10, 20, 30, &c. ſometimes 00, 200, 300, &c. according to he quality of the Queſtion pro-ounded.

By this Line you may alſo multi-ly, divide, work the Rule of Pro-portion, and perform divers things which the Line of Numbers perform-th, and ſome others which that will ot; but I ſhall here only ſhew you ow Board, Glaſs, Timber, Stone, &c. may be thereby meaſured; which I ſhall do in theſe following Propoſitions. And,

I. *For* SUPERFICIAL-MEASURE *as Board, Glaſs, &c.*

I. *In* INCH-MEASURE,

PROP. I.

A Plank being 27 *Inches broad, and* 263 *Inches long, how many ſquare Inches are contained therein?*

As 1 : to 27 :: So 263 : to 7101.

Take in your Compaſſes the diſtance from the Centre, to 27, (the breadth) upon your Line of equal Parts; with this diſtance ſet one Foot in 10, at the end of the Line, and open the Rule till the other Foot fall in 10, on the other Leg of the Rule.

The Rule thus ſtanding, take with your Compaſſes the diſtance between 263, on one Leg of the Rule, to 263 on

the other Leg; this diſtance will ach from the Centre of the Rule, 7101; and ſo many ſquare Inches e in that Piece.

PROP. 2.

a Board, or Plank, or piece of Pavement, or of Glaſs, be 20 Inches broad, how much thereof in length ſhall make a Foot ſquare?

As 20 : to 144 :: So 1 : to 7. 2.

Take 144, out of your Line of equal arts from the Centre, and ſetting e Foot in 20, open the other Leg ll the other Compaſs-point fall in o alſo.

The Rule thus ſtanding; take the ſtance between 10 and 10, and at diſtance will reach from the entre of the Rule to 7 Inches $\frac{2}{12}$ arts of an Inch; and ſo much in ngth will make a Foot ſquare.

II. *In* FOOT-MEASURE.

PROP. 3.

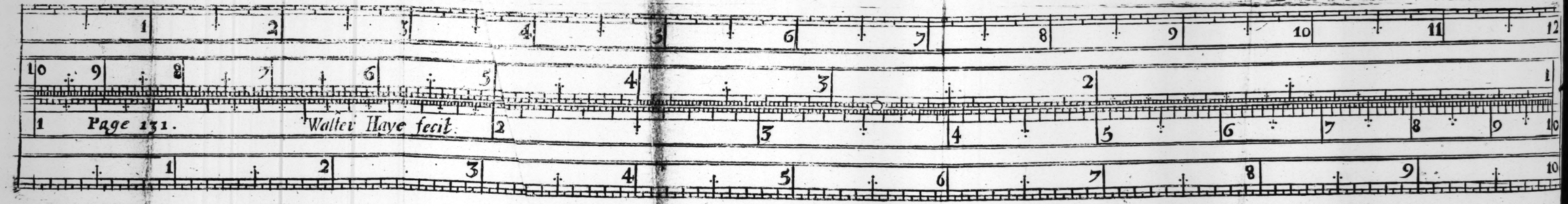
A Room is 52 *Foot broad, and* 110. *Foot long; How many ſquare Fe are there in that Room?*

As 52. : to : : So 110. 5 : to 57.

Take in your Compaſſes 52, t breadth; with this diſtance opent Ruler in 10, and 10; it ſo reſtin take the diſtance between 110. 5 a 110. 5 on every ſide; that diſtan applied to the Centre of the Ru will reach to 5746, and ſo ma ſquare Foot is in that Room.

PROP. 4.

A Plank being 2 *Foot,* 25 *parts bro how much in length thereof ſhall ma Foot ſquare?*


1 2 3 4 5 6 7 8 9 10 11 12
10 9 8 7 6 5 4 3 2 1
1 Page 131. Walter Haye fecit. 2 3 4 5 6 7 8 9 10
1 2 3 4 5 6 7 8 9 10

As 2. 25, the breadth,
is to 1, or 10:
So is 10,
to 44, the length of a Foot.

Take in your Compaſſes the di-
nce from the Centre of your Rule
1; then ſet one Foot in 2. 25, and
en the other Leg till the other
mpaſs-point fall in 2. 25, on the
her ſide: The Rule thus ſtanding,
e the diſtance between 10 and 10;
at diſtance applied from the Cen-
of the Rule, will reach to 44 parts
a Foot; and ſo much in length
ll make a Foot.

III. *In* YARD-MEASURE.

PROP. 5.

A Room is hung with Tapeſtry, containing 130 *Yards,* 25 *parts in compaſs, and in depth* 5 *Yards,* 20 *parts:*

How

How many Yards of Tapeſtry is that Room?

As 1,
to 5. 20:
So is 130. 25,
to 677. 4.

Take 5. 20 in your Compaſſe and that diſtance put over in t and 10; the Rule thus ſtanding, tak the diſtance between 130. 25 an 130. 25, on each Leg of the Rule that diſtance will reach from th Centre of the Rule to 677 Yards, tenths of a Yard.

II. *For SOLID-MEASURE, Timber, Stone, &c. by the Line equal Parts.*

I. *In* INCH-MEASURE.

PROP. 1.

Piece of Timber being 30 *Inches broad,* 21 *Inches,* 6 *parts deep, and* 183 *Inches long; How many Foot is contained in that Piece of Timber?*

As 1 : to 30 : : So is 21. 6, to 641.

Take the diſtance from the Centre, 30; then ſet one Foot in 10, and en the Rule till the other Compaſs- int fall in 10, on the other Leg of e Rule: Then take the diſtance be- een 21. 6, and 21. 6; that diſtance ll reach from the Centre of the le, to 648, the Content of the Baſe end of the Piece of Timber in In- es: Then,

2.

2. As 1728, the number of Inches in a Foot ſolid,
Is to 648, the Content of the Baſe:
So is 183 Inches, the length,
To 68 Foot, 62 parts, the Content in Feet

Take in your Compaſſes the diſtance from the Centre to 1728; with this diſtance ſet one Foot in 648, and open the other Leg of the Rule, till the other Point of the Compaſſes fall in 648, on the other Leg; then take in your Compaſſes the diſtance from the Centre, to 183; with this diſtance move both Points of the Compaſſes gently along on both the Lines, on either ſide the Rule, till the Compaſs-points reſt upon one and the ſame Number on either Leg; which you ſhall here find them to do at 68. 62 parts; ſo the Piece containeth

ainеth 68 Foot, and $\frac{62}{100}$ parts of a Foot.

This kind of Work may ſeem troubleſome at firſt; but a little Practice will render it eaſie.

Note, If you take the firſt Number of your Proportion from the Centre of your Rule, you muſt take your third Number thence alſo; and then will your Number ſought be found, as here in this Example. But if you take your firſt Number croſs the Rule, then your third Number muſt be ſo taken alſo, and your Number ſought muſt be taken from the Centre, as thoſe before were.

PROP.

PROP. 2.

If a Stone be 30 Inches broad, a
21 Inches, 6 parts deep; How mu
in length of that Stone will make
Foot ſquare?

You muſt firſt find the Content o
the Baſe, as is before taught, and i
will be 648 Inches: Then,

As 648, the Content of the Baſe,
Is to 1728, the Inches in a ſoli
Foot:
So is 1,
To 2. 67 parts.

Take 1728 in your Compaſſes from
the Centre: with that extent open
the Rule from 648, to 648: The
Rule ſo reſting, take the diſtance be-
tween 10 and 10; that diſtance ap-
plied to the Line from the Centre,
ſhall

l reach to 2 Inches, 67 parts; and much in length will make a Foot d, of that Stone or piece of Timber.

II. *In FOOT-MEASURE.*

PROP. 3.

a Stone or piece of Timber be 2 Foot, 50 parts broad, 1 Foot, 80 parts deep, and 15 Foot, 25 parts long; How many ſolid Foot doth that Piece contain?

As 1,
is to 2. 50, the breadth;
So is 1. 80, the depth,
to 4. 50, the Content of the Baſe in Feet.

Take 2. 50 in your Compaſſes from e Centre; with that extent open e Rule in 10 and 10; then take the ſtance between 1. 80, and 1. 80, that ex-

extent will reach from the Centre
the Rule, to 4 Foot, 50 parts, the co
tent of the Baſe.

2. As 1,
to 4. 50, the Baſe:
So 15. 25, the length,
to 68. 62, the Content in Fe

Take 4. 50, in your Compaſſes, a
thereto open the Rule from 10 to
then take the diſtance between 15.
and 15. 25: that diſtance will rea
from the Centre of the Rule, to
Foot, 62 parts, the Content of
Stone.

PROP. 4.

The breadth being 2 *Foot*, 50 *parts*,
depth 1 *Foot*, 80 *parts*; *How much*
length thereof will make a ſolid Fo

You may find the quantity or con-
t of the Baſe (by the firſt of the
t Propoſition) to be 4 Foot, 50
rts: Then,

As 4. 50, the Baſe,
is to 1;
So is 10, or 1 Foot,
to 222 Parts.

Open the Compaſſes from the
ntre, to 1: then ſetting one Foot
4. 50, open the other Leg till the
mpaſs-point falleth in 4. 50, on the
her Leg; then take the diſtance be-
veen 10 and 10; and that will reach
om the Centre, to 222; and ſo
any parts of a Foot will make a
lid Foot of that piece of Stone or
imber.

PROP. 5.

*o divide a Right Line into any num-
ber of Equal Parts, at the firſt open-
ing of the Compaſs.* Let

Let a Line be given to be divid
into 6 equal parts: Take the leng
of the Line given in your Compaſſ
then becauſe it is to be divided in
6 parts, put one Foot in 6, on one L
and open the other Leg till the oth
Point fall on 6, on the other Leg. T
Rule thus ſtanding, take the diſtan
between 1 and 1; that diſtance ſha
divide your given Line into 6 equ
parts. The like for any other Num
ber of parts whatſoever.

Many other Concluſions may b
done by this Line: but I ſha
reſerve them, and divers othe
Concluſions of the like natur
to a more convenient place.

The Uſe of the

Line of Proportion

IMPROVED;

which Board, Glaſs, Land, Wainſcot, Hangings, Pavement, Brickwork, Tyling, Plaiſtering, *and any other* Superficial; *As alſo* Stone, Timber, *and other* Solid Meaſure, *may be meaſured without the uſe of* Pen, Ink, Paper, Compaſſes, *or other* Motion (as ſliding, *or the like*) *whatſoever, by* Inſpection, *only by looking upon the* Line.

The ARGUMENT.

I Am not ignorant how many have written of the Uſe of this Line of Proportion ſince the Invention of Loga-

Logarithms, from which Tables t
Line is conſtituted and made;
namely, After Mr. *Gunter*'s firſt c
trivance, Mr. *Wingate* ſeconded hi
in making divers Lines to ſeveral R
dius's, thereby to bring it to extr
the Square and Cube Roots, witho
doubling or trebling, or dividing t
diſtance into two or three parts.
gain, Mr. *Will. Oughtred* diſpoſed
theſe Logarithmical Numbers in
verſe concentrick Circles, to be u
with an opening *Sector* to turn up
the common Centre, thereby to wo
Proportions; and hath written t
Uſes thereof in his Treatiſe, intitul
The Circles of Proportion. But nothi
here could be done without the he
of the Compaſſes.

Again, one *T. Browne*, a Maker
Mathematical Inſtruments, made
in a Serpentine or Spiral Line, co
poſed of divers concentrick Circl
thereby to enlarge the diviſions; wh

s the Contrivance of one Mr.——
lbourn, a *Yorkſhire* Gentleman, who
it thereof, and communicated his
es to the aforeſaid *Browne*, who
ce his death) attributed it to him-
; But whoever was the Contriver
t, it is not without inconvenience,
it can in no wiſe be made porta-
; and beſides (inſtead of Com-
ſes) an opening Joint with Thirds
ſt be plac'd to move upon the
ntre of the Inſtrument (as in the
mer Contrivance of Mr. *Oughtred*)
thout which no Proportion can
wrought.

There is yet a third way contrived,
which this Line is made very ſer-
ceable and convenient both for uſe
d carriage, and is to be uſed with-
t Compaſſes, and is compoſed of
o Lines of one length upon either
e of two Rulers, to ſlide one by
e ſide of the other; the uſes whereof
the meaſuring of *Board*, *Glaſs*, *Tim-*
r, *Stone*, &c. and in other parts of

Geo-

Geometry, *Aſtronomy*, *Fortification*, *T*
gonometry, *Geography*, *Navigati*
Gauging, *Dialling*, &c. together w
the Uſes of the Lines of Artifi
Signs and *Tangents*, in the ſame ma
ner contrived, all upon one Rul
are largely written upon by Mr. *S*
Partridge, in a Book of his lat
publiſhed, entituled, *The Deſcript*
and Uſe of the Double Scale of Prop
tion.

There is yet another way of diſp
ſing of this Line of Proportion,
having one Line of the full length
the Ruler, and another Line of t
ſame Radius, broken in two parts
tween 3 and 4; ſo that in worki
your Compaſſes never go off of t
Line. This is one of the beſt cont
vances; but here Compaſſes muſt
uſed.

Theſe are all the Contrivances th
I have hitherto ſeen of theſe Lin
That which I here ſpeak of, and w
ſhew how to uſe, is only two Li
up

on a plain Ruler of any length (the ger the better) having the beginng of one Line at the end of the ner, the Diviſions of each Line be- ſet ſo cloſe together, that if you d any Number upon one of the nes, you may eaſily ſee what Numr ſtands againſt it in the other Line. his is all the Variation: and what is eaſie Contrivance will effect, will pear by the Uſes following.

The Lines are the ſame with the ne of Proportion or Numbers, ntioned and treated of in the forer part of this Book: and therefore w to number upon them is ſhewed the firſt Chapter of this Book, and erefore needs not here again be reated: Alſo *Multiplication*, *Diviſion*, e *Golden Rule*, *Duplicated* and *Tricated Proportion*, the *Extraction of ots*, &c. delivered in the ſecond, ird, fourth, fifth Chapters, *&c.* as o in meaſuring of *Superficies* and

Solids, and the Menſuration of othe
Figures treated of through the whol
Book, theſe Lines thus diſpoſed wi
effect with Compaſſes: But ſome o
thoſe Uſes which they will effect i
meaſuring without the help of Com
paſſes, I will here ſhew.

CAUTION.

What Meaſure ſoever you meaſur
by, let the Integer or Grand Meaſur
be divided into 10 or 100 parts (
matters not of what length your Lin
of Proportion be, for to them a
Meaſures are alike.) Thus, if you mea
ſure any thing by the Foot, let you
Foot be divided into 100 parts: If b
the Yard, divide your Yard into 10
parts; If by the Ell, divide that int
100 parts. So likewiſe if by the Perc
Rod, *&c.* or by what Meaſure ſo
ver, let the Grand Meaſure (as I ſai
before) be divided into 100 parts.

CHA

CHAP. I.

Of SUPERFICIAL-MEASURE.

BY *Superficial Meaſure* is meant all kind of flat Meaſure, ſuch as *Board*, *Glaſs*, *Pavement*, *Hangings*, *Plaiſtering*, *Tyling*, *Land-meaſure*, &c. And theſe ſeveral things are meaſured by diſtinct Meaſures, as ſome by the *Foot*, others by the *Yard*, others again by the *Ell*, ſome by the *Rod*, and ſome by the *Square*: Of all which I ſhall give Examples: And,

I. *Of FOOT-MEASURE.*

Example 1. *If a Board be* 1 *Foot*, 64 *parts broad, how much in length of that Board will make a Foot ſquare?*

Look upon one of your Lines (it matters not which) for 1 Foot, 6 parts, and right againſt it on the other line, you ſhall find 61 ; and ſo many parts of a Foot, will make a Foot ſquare of that Board.

Example 2. *A Plank is* 3 *Foot*, 50 *parts broad, How much thereof in length will make a Foot?*

Find 3 Foot, 50 parts upon one Line, and right againſt it on the other Line, you ſhall find 28 parts and $\frac{4}{7}$, or ſomething more than half a part; and ſo much in length will make a Superficial Foot.

Example 3. *If a Board be* 75 *parts of a Foot broad, How much thereof in length ſhall make a Foot ſquare?*

Look

Look upon one of your Lines for 35, and right againſt it you ſhall find 1 Foot, 33 parts, and ſo much in length makes a ſquare Foot.

Note, If the breadth of any thing given be more than one Foot, then the length of a Foot ſquare muſt be leſs than a Foot, as in the two firſt Examples it was: But if the breadth given be leſs than a Foot, (as in this laſt Example) then the length of a Foot ſquare muſt be more than a Foot.

Example 4. *A Pane of Glaſs is* 35 *parts broad; How much in length makes a Foot?*

Find 35 in one Line, againſt it you ſhall find 2 Foot, 85 $\frac{4}{7}$ parts, and ſo much in length makes a ſquare Foot.

Example 5. *A Pane of Glaſs is 3 Foot broad, How much in length makes a Foot?*

Find 3 Foot in one Line, againſt it in the other you ſhall find 33⅓ parts; and ſo much in length makes a Foot ſquare.

Example 6. *If a Piece of Glaſs be 1 Foot, 98 parts broad; How much in length will make a Foot?*

Look 1 Foot, 98 parts in one Line, and againſt it in the other you will find 5 Foot and half a part; and ſo much in length makes a Foot.

II. *Of* YARD-MEASURE.

Example 1. *A Gallery is Wainſcoted 2 Yards, 56 parts deep; how much of that length will make a Yard ſquare?*

Seek

Seek 2 Yards, 56 parts in one Line, nd againſt it on the other you ſhall nd 39 parts and ſomewhat more; nd ſo many parts of a Yard will nake a Yard ſquare.

Example 2. *A Room is Wainſcoted 1 Yard, 13 parts high; How much in length thereof will make a Yard ſquare?*

Look one Yard, 13 parts in one Line, againſt it in the other you will ind 88 parts and above half a part; nd ſo much in length makes a Yard quare.

Example 3. *If the Frieze about a Room be 62 parts of a Yard broad; How much in length thereof will make a Yard ſquare?*

Find 62 parts in one of your Lines and againſt it in the other, you ſhall find 1 Yard, 61 parts, and ſomewhat more; and ſo much in length makes a Yard ſquare.

Example 4. *There is a Gallery paved with Marble, being* 5 *Yards* 70 *parts broad; How much of that in length will make a Yard ſquare?*

Seek 5 Yards, 70 parts in one Line, and againſt it in the other, you ſhall find 17 parts and an half; and ſo much in length of that Pavement will make a Yard ſquare.

Example 5. *A Parlour being* 7 *Yards* 29 *parts broad, hath a Cieling of Fret-work plaiſtered; How much of that breadth will make a Yard ſquare?*

Find

Find 7 Yards, 29 parts, in one of you Lines, and right againſt it in the other Line you ſhall find 13 parts, and $\frac{7}{10}$ which is above half a part: So that 13 parts and a little more than half a part will make a Yard ſquare of that Gieling.

Example 6. *A Plaiſterer hath Rendred the inſide of a Wall containing 2 Yards, 36 parts in height. How much of that will make a Yard ſquare?*

Find 2 Yards, 36 parts in one of your Lines, and right againſt it on the other you ſhall find 42 parts $\frac{3}{10}$ of a part, that is, ſomething more than one third part of a part; and ſo much in length makes a Yard ſquare.

III. *Of MEASURE by the ELL.*

Example 1. *There is a Room hung with Tapeſtry, which is 4 Ells, 25*

parts high; How much Tapeſtry in length will make an Ell ſquare?

Note, Here by Ells we underſtand *Flemiſh* Ells (for by that Meaſure are Hangings ſold;) which Ell contains three quarters of our Yard; that is, 75 parts of our Yard. So that if an Upholſterer have his *Flemiſh* Ell divided into 100 parts, he may meaſure his Hangings as in the Examples following is ſhewed.

Here becauſe the Hangings are 4 Ells, 25 parts deep, Look for 4 Ells, 25 parts in one of your Lines, right againſt which in the other you ſhall find 23 parts and a half, and ſo many parts of his Ell will make a *Flemiſh* Ell ſquare.

Ex-

Example 2. *The Embroidery of a Pair of Vallens about a Bed is* 28 *parts of a Flemiſh Ell deep; How much of that Embroidery in length will make a Flemiſh Ell ſquare?*

Look for 28 parts in one of your Lines, and againſt it in the other Line you ſhall find 3 Ells, and 57 parts of an Ell; and ſo much in length will make an Ell ſquare.

Example 3. *A Gallery being* 3 *Ells,* 98 *parts deep, is hung with Arras; How much of that depth will make an Ell ſquare?*

Seek 3 Ells, 98 parts in one Line, againſt which in the other you ſhall find 25 parts and $\frac{1}{10}$ of a part; and ſo much in length will make an Ell ſquare.

IV. *Of MEASURE by the ROD.*

Example 1. *There is a Brick-Wall, which is 75 parts of a Rod high; How much in length of that Wall will make a Rod ſquare?*

Note, That all Wall-work is by the Brick-layers meaſured by the Rod, which contains 16 Foot and an half in length: Wherefore, let his Rod, being 16 Foot and an half in length, be divided into 100 equal parts, and then let him work as followeth.

The Wall being 75 parts of a Rod high, Look for 75 parts in one Line, and in the other Line right againſt 75, you ſhall find 1 Rod, 33 parts of a Rod; and ſo much of that Wall in length is contained in a ſquare Rod.

Ex-

Example 2. *A Carpenter hath Railed and Paled in a Garden, with Pales 52 parts of a Rod high; How much of that Pailing ſhall make a Rod ſquare?*

Seek 52 parts in one Line, againſt in the other Line you ſhall find Rod, 92 parts; and ſo much in ngth will make a ſquare Rod of that aling.

Example 3. *A Brick-layer hath made a Shewer to carry Water; the Bottom, Sides, and Arch, together contain 1 Rod, 64 parts; How much of that Drein or Shewer makes a ſquare Rod?*

Find 1 Rod, 64 parts, in one of your ines, and right againſt that Number ou ſhall find in the other Line almoſt 1 parts; and ſo many parts of a Rod a length will make a Rod ſquare.

And

And here note, That though I have here put these two last Examples that Paling is not measured by the Square Rod, but (let the height thereof be what it will) it is measured by the Rod in length: In like manner is Hedging, Ditching, and many other things that are measured by the Rod.

Example 4. *If a piece of Land be 2 Rod, 31 parts broad, how much in length thereof shall make a Rod square?*

Seek 2 Rods, 31 parts upon one of your Lines, and over-against it upon the other Line you shall find 42 parts and about $\frac{2}{3}$ of a part; and so much in length makes a square Rod.

Example 5. *A Piece of Land being 80 parts of a Rod broad, How*

How much thereof in length ſhall make a Rod ſquare?

Look for 80 parts in one line, and in the other line oppoſite thereunto you ſhall find 1 Rod, 23 parts, and ſo much in length makes a Rod ſquare.

V. *Of MEASURING by the SQUARE.*

There are two things principally which are meaſured by the Square, and they are Tyling of Houſes, and Flooring of Rooms; and in this reckoning they account a Square to be 10 Foot every way: So that for this kind of Meaſure divide a Line or Rod of 10 Foot long into 100 parts, and it is fit for the purpoſe.

Example 1. *A Barn, the breadth of the Tyling whereof on both ſides is* 1 *Square,* 30 *parts; How much in*

in length of that Tyling will make a ſquare?

Find 1 Square, 30 parts, upon one of your Lines, and right againſt it on the other line you ſhall find 77 parts almoſt; and ſo much in length of that Tyling will make a Square.

Example 2. *The Tyling of a Houſe, is 76 parts of a Square broad; How much in length thereof will make a ſquare?*

Seek 76 parts in one Line, and againſt it in the other you ſhall find 1 Square, 31 parts and a half almoſt: and ſo much in length will make a ſquare Square, that is, 10 Foot every way, in all 100 Foot.

CHAP.

CHAP. II.

Of SOLID MEASURE.

BY *Solid Meaſure* is meant ſuch *Meaſure* as hath *Length*, *Breadth* and *Thickneſs*; ſuch as *Timber*, *Stone*, or the like. But before Timber or Stone can be meaſured, you muſt find the Content of the Square of the Baſe thereof, which is taught by the Problem, at the end of the Tenth Chapter: But that being performed by Compaſſes, I will here ſhew how it may be (by theſe Lines thus diſpoſed) performed without; and that ſhall be my firſt Propoſition or Example.

Example 1. *Let a Piece of Timber or Stone, be* 80 *parts of a Foot deep,*

deep, and 3 *Foot,* 75 *parts broad How much in length of that Piec will make a Foot ſquare ?*

Here (by any of the former Rule of Superficial Meaſure) find at 8 parts broad, how much in length wi make a Foot, which you will find t be 1 Foot, 25 parts: For,

If you find 80 parts, the depth o the Piece in one line, againſt it i the other you ſhall find 1 Foot, 2 parts. Take 1 Foot, 25 parts of you Foot Rule, and meaſure it along th breadth of the Piece, which is 3 Foot 75 parts, and ſee how often it is con tained therein, which you ſhall fin to be three times: wherefore, yo may conclude, that the Square of th Baſe of that Piece of Timber whoſ depth is 80 parts, and whoſe breadth is 3 Foot, 75 parts, is juſt 3 Foot.

Now the Square of the Baſe of the iece being thus obtained, you may nd the length of a Foot ſolid there- in this manner.

xample 2. *Let the Square of the Baſe of a piece of Timber or Stone be* 3 *Foot*; *How much in length of that Piece will make a Foot Solid?*

Look for 3 Foot in one of your nes, and in the other right againſt you ſhall find 33 parts and $\frac{1}{3}$ part a part; and ſo much in length will ake a Foot ſolid.

xample 3. *Let a Piece of Stone or Timber be* 2 *Foot*, 50 *parts broad, and* 50 *parts deep*; *How much of that Stone in length ſhall make a ſolid Foot?*

By any of the ways before preſcri- ed, you ſhall find that the depth of your

your Stone being 50 parts, it will re
quire 2 Foot in length thereof t
make a Foot ſquare: Wherefore
meaſure how often you can find
Foot in the breadth of your Solid
which you can find only once
and 50 parts more, which is on
quarter of two Foot: Wherefore
the Square of this Solid contain
1 Foot, 25 parts. Wherefore, Loo
in one of your Lines for 1 Foot, 2
parts, and right againſt it you ſha
find 80 parts; and ſo much in lengt
will make a Foot ſolid.

Example 4. *The Square of the Ba of any Regular Solid being given together with the length of the ſame Solid; To find how many ſoli Feet are contained in the ſame.*

Let the forementioned Solid ſerv
for this Example alſo, whoſe lengt
was 32 Foot: We found that th
Squar

quare of the Baſe was 1 Foot, 25 arts, and that 80 parts in length ould make one ſolid Foot: Where- re, take 80 parts of your Rule, d run it along the Piece as often as ou can, which you ſhall find to be o. So that in this Piece of Timber here is 40 Foot.

might add many more Examples of this kind, and ſome to other purpoſes; but theſe are ſufficient for the purpoſe intended. And ſo I ſhall conclude this Treatiſe, leaving the farther Practice thereof to your ſelf: For,

Uſus optimus Magiſter.

CHAP.

CHAP. III.

Of CIRCULAR MEASURE

By having either the Circumference or Diameter of any Circle given thereby to find the Side of a Square equal to the same Circle, or the Side of a Square that may be inscribed within the same Circle.

IN the Thirteenth Chapter of this Book you have six Examples, by having the Circumference or Diameter of any Circle given, thereby to find the Side of a Square equal to the Superficial Content, *&c.* But I have seen upon some Two-foot Rules Lines to effect this thing, by only opening the Compasses to the distance given upon one Line, and applying the

e ſame to ſome of the other Scales: ne of thoſe Scales is noted at the d thereof with *C*, ſignifying the ircumference of any Circle: the her with *D*, ſignifying the Diame- r: the other with *S. E*, ſignifying quare Equal to the Circle: the other ith *S. W*, ſignifying Square Within.

Example. So that if I ſhould have iven you the Diameter of a Circle, eing 15 Inches; out of the line oted with *D*, take 15 inches: apply hat diſtance to the line noted with , it will reach to 47 Inches and $\frac{13}{100}$ arts of an Inch: and ſo much is the ircumference of that Circle.

Again, the Diameter being 15 nches, as before, take that Diſtance ut of the line *D*, and it will reach pon the line *S. E*, to 13 inches $\frac{29}{100}$ arts: and that ſhall be the ſide of a quare equal to the Circle whoſe iameter is 15 Inches.

Again,

Again, The Diameter being
Inches, if you take that diſtance o
of the Line noted with *D*, it w
reach upon the Line *S. W*, to
Inches $\frac{60}{100}$ parts of an Inch: a
that is the length of the Side of t
greateſt Square that can be draw
within that Circle whoſe Diamet
is 15 Inches.

The like may be done, if the Ci
cumference were given, by takin
the Circumference thereof out of t
Line noted with *C*, and applying
to the other Scales.

This I thought convenient to ad
here, becauſe ſometimes theſe Lin
are put upon Two-foot Rules.

FINIS.